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ELECTRICAL CONTRACTING

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Contents

5—"Calling All Power Companies!"—*An Editorial*
7—Rising Prices—Watch Out!
8—Instruments at Work
11—Check List of Hazards
12—Installing Mercury Lighting—*By W. G. Darley*
14—Handling Multi-Conductor Cables—*By Albert A. Schuhler*
16—Looking in on Lincoln Bush—*By Earl Whitehorne*
18—Pictures Sell Re-Wiring
20—They Like the Gadget Idea
22—How to Use the Handbook 2.—*By Richard G. Slauer*
24—Variables in Labor Costs—*By William A. Richter*
32—Editorials
51—Feature Section on Maintenance

Service Departments

36—Methods of Other Contractors
44—Among the Motor Shops
48—For Better Lighting jobs
66—Questions on the Code
74—Questions on Signalling
80—High Lights in the News
92—News of NECA
95—New Trade Literature
98—With the Manufacturers
102—Equipment News
112—Advertisers' Index

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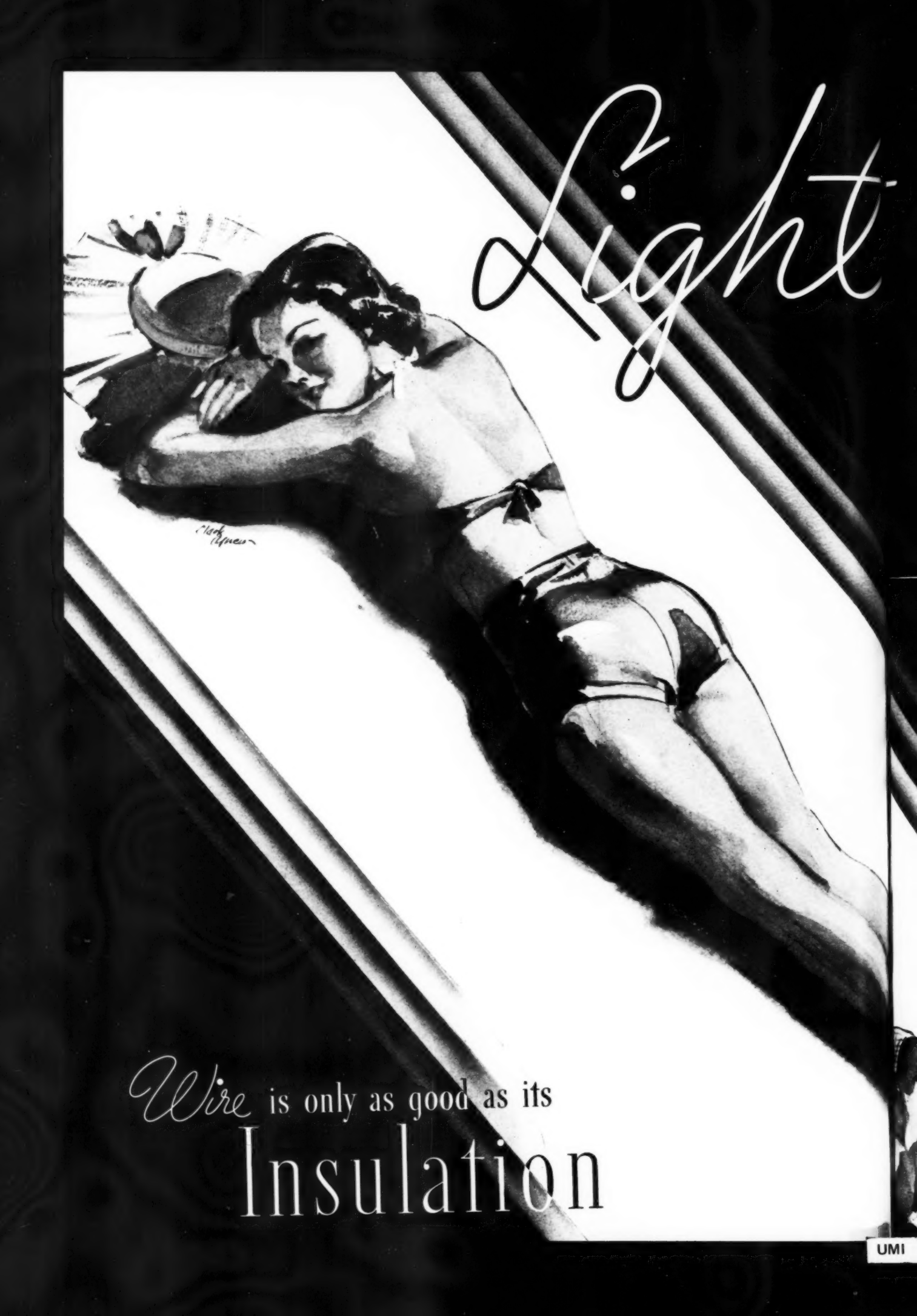
Light
Wire is only as good as its
Insulation

LIKE A SUNBURNED SKIN, the insulation of a wire or cable, cracked and dried by light, is no longer a protective coating.

RESISTANCE TO LIGHT is a vital property where the usefulness of an electrical conductor is measured by the unbroken life of its insulation. Tough compounds of U. S. Tempered Rubber, tested in the laboratory by searing ultra-violet rays, and proved in service under tropic suns, successfully resist the destructive action of light. Because U. S. Tempered Rubber will not readily crack or dry out, its use as insulation increases the usefulness of conductors by prolonging the life of their protective coatings. That is why the buyer or the seller of electrical conductors will find an extra margin of profit in U. S. Rubber Insulated Wires and Cables.

BAKED AND BURNED under an artificial sun. Here U. S. Tempered Rubber insulation is being tested for resistance to life-sapping ultra-violet rays. This sort of careful and unremitting laboratory testing insures the successful performance of U. S. Tempered Rubber insulation under all adverse field conditions.

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ELECTRICAL CONTRACTING

MAY
1937

"Calling All Power Companies!"

AN OLD COLORED PREACHER, in Culpeper, Virginia, made a remark to me one day that I have never forgotten. He said—"Seem's like, when a man aint in trouble his prayin' don't have no suction, somehow."

IT IS MUCH THE SAME WITH SELLING. And that's why it's a good thing the whole electrical industry, right now, has its brow puckered over wiring. We have begun to realize that inadequate, overloaded wiring is gradually blocking the road to further sale of light and appliances in all types of buildings. We are worried and know that something must be done.

IT IS CLEAR TOO that the job must start in the home. That's where the need is most urgent and where the idea must first be sold. But there is one influence that has long discouraged progress there. The power companies are convinced that wiring—all wiring—costs too much. They have hung back, waiting to develop some new, cheaper wiring material that needs less labor. And this doubt—this resistance—has slowed down everybody.

BUT THE TIME HAS COME when we can wait no longer. And if we face these facts, we will not want to wait—

Lumber costs too much. But having no cheaper material, we go ahead and build houses—even of brick and stone.

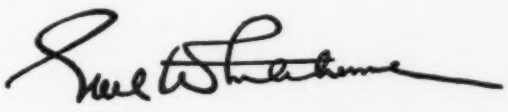
Plumbing costs too much. But we still install iron pipe—and sometimes brass.

Painting costs too much. But there being no substitute for saving the surface—why, we paint.

Wiring may also cost too much. But we can't enjoy electricity without it. And so some 22,000,000 homes have been wired anyway.

SO THERE IS NO REASON TO WAIT for cheaper wiring. Let's take the wiring that we have and get the job done. Meanwhile, research can continue and if some less expensive method comes, it will be welcome. But by any system, now in use, the cost of wiring is very small, when added to the monthly financing of a house.

THE PUBLIC HAS NOT REFUSED to buy adequate—full comfort wiring. We have just failed to make them want it—that's all. Now we're in trouble. Let's quit holding back and get behind wiring with the full strength of a united industry. Let's put some suction in our selling.



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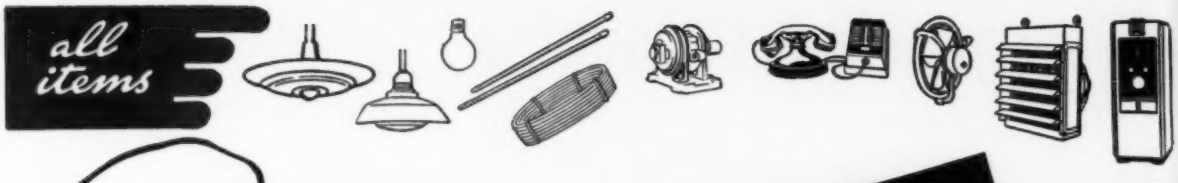

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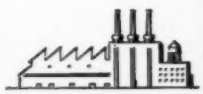
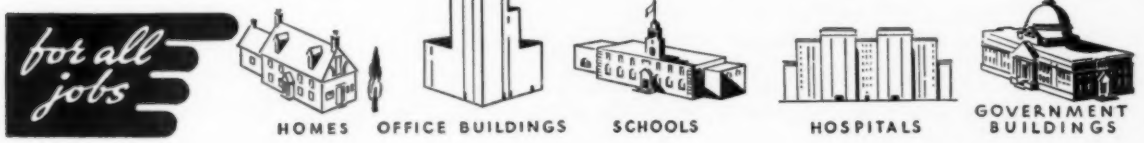
APARTMENT BUILDINGS


FACTORIES



Rising Prices—*Watch Out!*

LIONEL D. EDIE

WHEN prices start climbing, every contractor knows what he ought to do. There are five simple rules that he should follow:

1. Make no bids without a cancellation clause.
2. Call in all outstanding bids, based on prices that are now too low.
3. Purchase all materials needed to cover actual commitments.
4. Build up inventories on staple stocks.
5. Take full profits in all sales of stock on hand. Price it at the market to compensate for losses coming on delayed purchases.

Everybody in the construction industry knows these rules. But many contractors, at times, neglect to observe them and lose good money that has been hard earned on other jobs. In many cases it is because they fail to appreciate soon enough the meaning of the upward trend in prices and its bearing upon their own business. They fail to adjust themselves to it until the price movement is well on the way and has already involved them deeply.

Why are prices rising now? What should the electrical contractor expect this year and next? We put these questions to the well known economist, Dr. Lionel Edie. He says:

"In the past seven years that spanned the depression and the first phases of our economic recovery in this country, factories were badly neglected. Equipment deteriorated through both obsolescence and lack of care and replacement. The productive capacity of American industry was impaired.

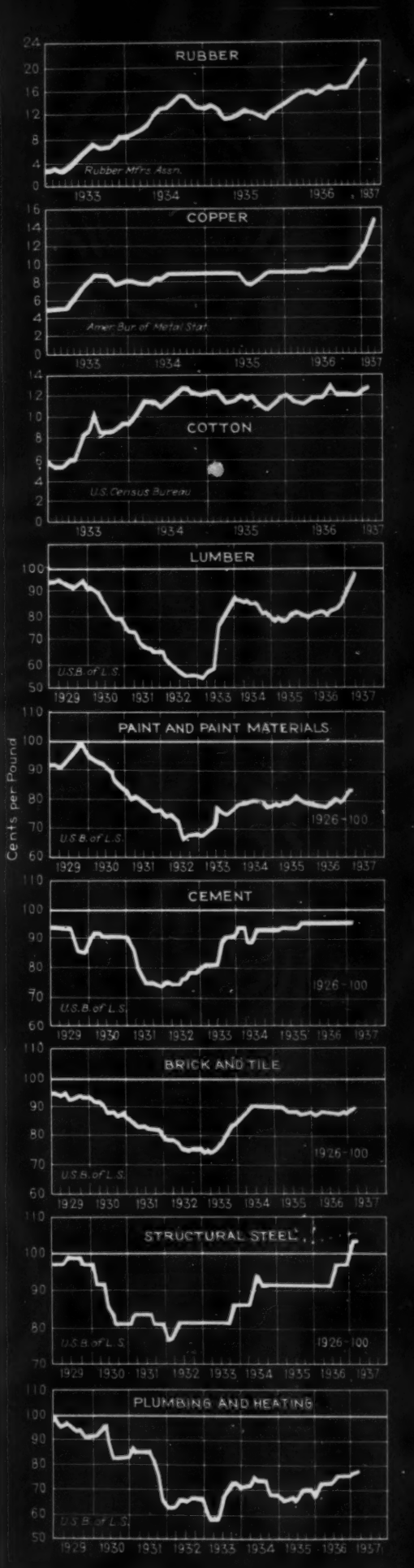
"Now comes a rapidly increasing demand for products of every kind. Orders are flowing in in such volume that manufacturers cannot turn out the goods and ship them fast enough. The two principal reasons are the run down condition of machine equipment and the shorter hours or other restrictions that labor has imposed. The natural result is that everybody begins to stiffen prices on raw materials, on parts and on the finished products.

"At present all this looks very ruinous to the manufacturer and to other business men. But the trouble will probably cure itself by the natural forces that will come out of it. Last year we were enjoying the first phase of our recovery, in which every manufacturer was striving to put his house in order, modernizing his plant and equipment and increasing his output. And business boomed.

"Now, rising prices, labor unrest and higher costs are forcing many readjustments. But business is still increasing, and strikes will end. Prices will react in balance with cost and demand. And this second phase of our recovery will pass into the third.

"Production today has reached a level where present capacity in many lines is already being strained; hence, if recovery is to continue, it must take the form of additions to capacity. As output increases further, the actual expansion of factories will commence. This will be the third phase of recovery and I hope it will take form by autumn."

So with a building recovery in process, every electrical contractor better watch out for prices and watch out for some time. The old Revolutionary advice, "Trust in God and keep your powder dry," is still good. But it pays to put most of your attention on the powder. Then when conditions swing around your way again—you are still there.



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Instruments At Work

Typical Case Studies That Show How The Right Equipment Helps Bring In Industrial Business

CORRECT MOTOR SPEEDS *(above) are vital to efficient pump operations. Here a motor speed test is being made in a pump room with a Horn Universal hand tachometer.*

INSULATION READINGS *(below) made at a switchboard with a two-range Junior Paragon Megohmer indicate the condition of important motor feeders.*

PRESENT day industry is characterized by ever higher standards of precision, complexity of methods and materials, severe competition and large production. So to sell electrical services to factories, you must be in a position to give facts and not just an opinion. Rule-of-thumb or hearsay methods no longer have a place in modern business.

Contractors and industrial specialists, should be equipped with instruments that enable them to analyze electrical problems with accuracy. If feeder capacities must be increased, power factor corrected, lighting keyed to complex seeing tasks, or drives and controls coordinated, there is no guessing and they will know just what to do. Here are a few examples that show the value of instruments in the hands of experienced engineers.

Pacific Electric Motor Co., Oakland, Cal.

1. Clay Products Plant: An air compressor had just been installed, was driven by a 50-h.p., 3-phase, 220-volt motor, located distant from the transformers. On first trial of the compressor, the motor would not come up to speed. Each time an attempt was made to start the compressor, other motors on that same feeder would trip off the line.

Testing with an a.c. voltmeter showed

FACT PRODUCERS: *Industrial surveys and tests requiring one or more of these precision instruments are an everyday chore with the Pacific Electric Motor Company of Oakland, Calif. Here are portable demand meters, volt meters, ammeters, wattmeters, current transformers, tachometers and other equipment for making all sorts of exhaustive tests.*

that the voltage dropped to 150 volts. A complete voltage and load survey was then made throughout the plant. Connected load was checked and future expansion was considered. All these findings were then put together and analyzed. As a result, the plant service was changed to 440 volts. No further trouble was experienced. The plant has grown and today is still free from voltage difficulties.

2. Manufacturer of Bearing Equipment: The plant was being enlarged, which required moving to a new location. A majority of the motors were served by 250 volts d.c., while the new plant was to be served by 440 volts, 3-phase, a.c.

A survey was made. Each motor was tested with a d.c. ammeter, voltmeter and tachometer to determine the proper horsepower and speed of the new a.c. motors to be installed. The main service was also tested and checked against the power company demand. A 10 kw. motor generator set was installed to serve special machines for which d.c. motors could not be changed without undue expense.

3. Large Flour Mill: A power survey was made to determine the best method of raising the power factor. Graphic wattmeter and current readings were taken on each motor embracing amperes, volts, kilowatts, temperature and speed. From this, power factor, hp. input, hp. output, and approximate efficiency were calculated.

Among the various motors were two 250 hp., 290 r.p.m., 440-volt, 3-phase induction motors, each driving a line shaft. It was thought that by replacing these motors with the proper synchonous type, the power factor could be raised. But upon installing graphic wattmeters and ammeter, it was found that these motors pulled exactly full load and at this load these motors had their best characteristics.

Calculated hp. output showed 256 hp. at 88% power factor, temperature rise 32°C. A good number of motors were underloaded. It was found, therefore, that with the installation of a 250 hp. 80% power factor, leading, synchronous motor, a saving of $900 a year could be made. Also, by remotoring certain drives, a further saving was made through power factor and higher efficiency.

4. Paper Products Company: A process machine was connected through a speed reducing drive, to a 15 hp. 1800 r.p.m., squirrel cage motor, giving 4-1 ratio. Trouble was experienced with speed control, as a very fine balance of speed had to be obtained, to prevent a large spoilage of products. Analysis of the machine and drive was made by connecting a polyphase indicating wattmeter and an ammeter in the motor circuit, and by recording various speeds of the motor and machine. These wattmeter readings, together with the speed data records and number of processed units, were all plotted on a chart. Further analysis showed that a d.c. motor drive would be superior.

The final result was the installation of a special d.c. drive consisting of one 20 kw. motor generator set and one 15 hp., d.c. motor together with variable voltage control. The new drive gave excellent results, reducing spoilage to practically nothing. About a 10-1 speed ratio was obtained with very smooth acceleration. The success with this drive resulted in three more of the same type being installed.

Raphael Electric Co., Pittsburgh

Case No. 5 Glass manufacturing plant: With the use of an industrial analyzer we conducted complete tests on all of this company's motors. This test and our detailed recommendations for applying proper size motors resulted in the elimination of over-motored conditions in this plant. Power factor was automatically improved thus affecting an over-all reduction in power bills.

Case No. 6 Tool Manufacturing Plant: Accurate tests were made to determine the amount of energy consumed to drive line shafts, belts, pulleys, etc.

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voltage surveys were conducted to determine the condition of existing riser and distribution circuits. With this information we proposed a wiring system of adequate capacity to take care of contemplated load increases. The building management gave our company a contract to make complete changes in accordance with recommendations made from tests.

Independent Wiring Co., Philadelphia

Case No. 7. A Loft Building, constructed about 1914 had been generating 3 phase 440-volt current. Lighting employed three single-phase 250-kva., 440/110-v. transformers.

Originally, the occupants of this building were running on two or three shifts, but during the depression the total load for lighting was considerably less. As a result the transformers were heating excessively due to the reduced load.

Tests were made with a recording wattmeter, a graphic type demand meter and a power factor meter, which disclosed a load of less than 25% of the rated transformer capacity. Excessive reactions affected the overall power factor, and caused undue heating.

Excessive amounts of sediment were found in the transformer oil, also a heavy sludge deposit over the transformer coils, and through the oil circulating ducts. This restricted the free oil from circulating and transferring heat from the windings.

The coil insulation was tested from primary to ground, secondary to ground, and from primary to secondary, using a "Megger" for this test. These tests disclosed very low insulation between the primary and secondary coils. Further investigation proved that these transformers had been operated sometime at a heavy overload, which had partially carbonized the insulation. The transformers were actually four times as large as necessary; were operating inefficiently; the oil was defective due to sediment; the insulation had deteriorated due to excessive heat from the overload, and the power factor was low due to excessive reactive conditions.

These facts caused our client to buy three 100-kva. transformers from us to replace the original transformers.

Case No. 8. Another building where six transformers operating on 2300v. primary, 115/230-v. secondary were heating excessively. Samples of oil secured from one bank of transformers broke down at less than 6000 volts. This bank had low insulation readings with the old oil. The oil was removed, coils treated, transformers filled with new oil, after which the insulation test showed standard values.

Two other banks of transformers had been in service longer than the bank just mentioned. The oil in these two banks was very dirty, and the coils were covered with a heavy deposit of sediment. After the oil was drained from these transformers, the coils washed and treated, refilled and tested, the two banks tested up to accepted operating characteristics.

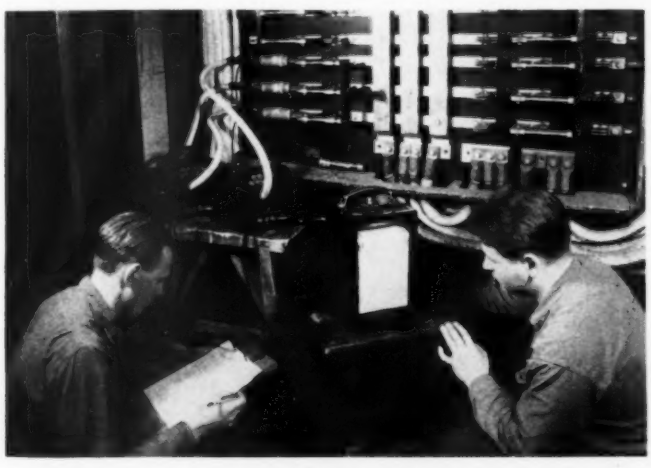
Case No. 9. Elevator Pumping System. The motors were supplied by one manufacturer, starting equipment by another, and the pumps by another. When trouble developed in the controllers, the manufacturer was reluctant to accept responsibility for difficulty in his equipment.

A graphic type wattmeter was installed on the line which showed the motor operating at 95% load when starting, and a decreased load to 80% of full load at the shut-off period. In view of this condition, the controller manufacturer had to accept responsibility and remedy the condition.

Case No. 10. Industrial Plant. A 100-hp. synchronous motor had been difficult to start from the time of installation. A graphic type wattmeter, voltmeter and ammeter were installed on the motor circuit, together with a graphic type voltmeter and ammeter on the exciter circuit. The charts indicated that the time-delay relay was not properly adjusted and was not throwing the current into the field at the proper time. This condition was corrected for our client at a nominal fee and we have done several hundred dollars worth of work since that time.

Building owners and managers demand engineering information as to existing operating characteristics and efficiency as compared with those of proposed changes. The electrical contractor is therefore called upon to supply reports showing the benefits and advantages which may be experienced from the changes he proposes.

Meters of guaranteed accuracy and of various types are required for this work. In the old days, the electrical contractor equipped himself with a volt meter, ammeter and wattmeter of indicating type. The present day contractor requires not only these instruments, but integrating watthour meters of various sizes, some meters equipped with sweep-hand demand attachments, and others with graphic recording demand attachments. He also needs megohmmeters and rotating standards.



LOAD TESTS *are being made with an Esterline-Angus recording wattmeter at the distribution center in a New York City office building.*

Check List Of Hazards

Cleveland Inspectors Use Check List And Cover 140 Causes Of Fires Or Accidents

IN reporting an electrical fire or accident, the inspector has three objectives. He wants to make a complete and accurate report, to get it done quickly and to have it simple enough so it will be read.

Cleveland has found that detailed investigations can be reported without laborious writing, by using a report form that lists the 140 commonly known hazards. Each hazard has its key number that may be checked. Spaces are provided for writing in essential facts. Then the causes are checked. For general investigations that do not require such a highly detailed report, a simplified form is used.

Completed reports are filed numerically for easy future reference. Fire reports are prefixed "F" and accident reports, "A", followed by the month, year, and number of the case. For instance, an electrical fire investigation occurring in December 1936 would be number F-12-36-324, assuming that 324 such reports had been made by that time of the year. The first report for the year 1937 would be numbered F-01-37-01, and the first accident report, A-01-37-01. All correspondence and permits have the report number noted on them to aid quick reference to the investigation report at some future time.

140 Hazards—Cleveland inspectors use this list to run down causes.

STANDARD CLASSIFICATION OF FIRES OR ACCIDENTS OF ELECTRICAL ORIGIN

This form groups electrical fires into 10 types listed in column A. In column B the type is either subdivided or some other descriptive detail added. In column C all of the actions or conditions that are known causes of electrical fires are listed. These are numbered in column D. This number indicates the cause of the fire and is to be used in answering question No. 3 in the Standard Report Form.

A	B	C	D
	Occuring on Equipment Having a Tendency to Create Same During Operation.	Careless handling	1
		Enclosure defective or left open	2
		Failure to provide enclosure	3
		Hazardous location	
		Class I — Equipment not approved for use in this location.	4
		Class II — Equipment not approved for use in this location.	5
		Class III — Equipment not approved for use in this location.	6
		Inflammable materials being used temporarily in this location	7
		Maintenance improper; Failure to keep clean	8
ARCS OR SPARKS	Resulting from Broken Wires or Connections.	Careless handling	9
		Corrosion as a result of moisture	10
		Corrosion as a result of acid or fumes	11
		Injury: Accidental after installation	12
		Injury: By mechanics when installed	13
		Injury: Resulting from ordinary service	14
		Manufacture defective	15
		Storm	16
		Terminal connection improperly made	17
		Terminal screws loose	18
		Unknown	19
		Vibration due to defective fastening	20
		Vibration due to location	21
	Breaking Lamp.	Careless handling	22
		Guard not approved	23
		Guard not provided	24
		Guard approved: Breakage due to unusual conditions	25
		Manufacture defective	26
		Unknown	27
	Accidental Contact.	Careless handling	28
		Guard or enclosure not approved	29
		Guard or enclosure not provided	30
CONTACTS HEATING OR ARCING	Of Equipment Carrying Current Under Normal Operating Conditions. Does Not Apply to Grounding Connections.	Corrosion as a result of moisture	31
		Corrosion as a result of acid or fumes	32
		Heat: Location excessively hot	33
		Injury: Accidental after installation	34
		Injury: By mechanics when installed	35
		Injury: Resulting from ordinary service	36
		Joints: Improperly made	37
		Maintenance improper: Failure to keep clean	38
		Manufacture defective or not approved	39
		Mechanical failure: Cause unknown	40
		Oil	41
		Over-loading	42
		Operation of switch or motor starter improper	43
		Terminal connection improperly made	44
		Terminal screws loose	45
		Unknown	46
		Vibration: Due to defective fastening	47
		Vibration: Due to location	48
		Weather proofing not provided	49
CROSSES	Primary Current Entering Building Over Secondary Wires.	Clearance: Not standard	50
		Falling wires: Cause unknown	51
		Falling wires: Accidental during installation	52
		Falling wires: Installation defective	53
		Falling wires: Storm	54
		Transformer installation failure	55
	Resulting in Primary Currents Entering Building Over Signal Wires.	Clearance: Not standard	56
		Falling wires: Cause unknown	57
		Falling wires: Accidental during installation	58
		Falling wires: Installation defective	59
		Falling wires: Storm	60
	Resulting in Foreign Currents Entering Building Over Signal Wires Due to Contact Between Signal Wires and Secondary Light and Power Wires.	Clearance: Not standard	61
		Falling wires: Cause unknown	62
		Falling wires: Accidental during installation	63
		Falling wires: Installation defective	64
		Falling wires: Storm	65
	Resulting in Currents from Secondary Lighting and Power Wires Entering Building Over Radio Aerial.	Clearance: Not standard	66
		Falling wires: Cause unknown	67
		Falling wires: Accidental during installation	68
		Falling wires: Installation defective	69
		Falling wires: Storm	70
GROUNDING DEFECTIVE	Applies to Any Defect on the Grounding of Interior Wire Ways; Wire Way Attached to Outside of Building Also Fixtures.	Not of sufficient carrying capacity	71
		Conduit system not continuous	72
		Corrosion as a result of moisture	73
		Corrosion as a result of acid or fumes	74
		Fittings loose: Lock nut, coupling, bushings, etc.	75
		Ground clamps loose	76
		Ground connection omitted	77
		Ground connection not approved	78
		Ground: Driven type: Improperly made	79
		Ground: Driven type: Resistance high due to location	80
		Ground connections: Removed or damaged	81
		Unknown	82
		Vibration	83
	Applies to Any Defect on the Grounding or Failure of Ground on Service Co.'s Distributing Equipment.	Corrosion as a result of moisture	84
		Corrosion as a result of acid or fumes	85
		Ground clamps loose	86
		Ground connection omitted	87
		Ground connection not approved	88
		Ground: Driven type: Improperly made	89
		Ground: Driven type: Resistance high due to location	90
		Ground connections: Removed or damaged	91
		Unknown	92
HEATED OR HEATING APPLIANCES OR EQUIPMENT INCLUDING LAMPS	Left in Circuit Unattended and in Contact or Too Close to Combustible Material.	Careless handling	93
		Pilot light not provided	94
		Pilot light out of order	95
		Lamp guard removed or not provided	96
		Lamp guard not approved	97
INSULATION FAILURE	Of Wires or Windings.	Acid or acid fumes	98
		Heat from lamps	99
		Heat: Location excessively hot	100
		Injury: Accidental after installation	101
		Injury: Failure to use proper fittings	102
		Injury: By mechanics when installed	103
		Injury: As a result of ordinary service	104
		Manufacture defective	105
		Manufacture defective: Not approved	106
		Moisture: Failure to make weatherproof	107
		Moisture: Due to condensation	108
		Moisture: Due to leaking roofs or piping	109
		Oil	110
		Tampering by incompetent persons	111
		Taping defective	112
		Unknown	113
		Vibration: Due to defective fastening	114
		Vibration: Due to location	115
		Water or other conducting liquid accidentally spilled	116
LIGHTNING	Entering Building Over Light-ing, Power, Radio or Signal Wires.	Lightning arrester not required	117
		Lightning arresters not provided	118
		Lightning arrester not approved	119
		Discharge in excess of arrester capacity	120
MOTION PICTURE FILM IGNITION	Film Stopped in Light Rays of Projector.	Failure of starting mechanism of a single phase motor	121
		Film defective	122
		Sprockets defective	123
		Mechanism other than sprockets defective	124
		Unknown	125
	Ignited by Contacts with Hot Electrical Equipment or Other Objects.	Lamps	126
		Lamp house	127
		Carbons	128
		Smoking	129
		Unknown	130
OVERLOADING	Of Wires, Windings or Other Current Carrying Equipment.	Automatic Protection: Capacity of wire less than 15 amperes	131
		Automatic protection: In excess of capacity	132
		Careless handling	133
		Connections in error	134
		Locked Rotor: Due to single phasing	135
		Locked Rotor: Other than single phasing	136
		Switch mechanism on automatic control defective	137
		Unknown	138
UNAPPROVED WIRING METHOD	Does Not Include Cases of Approved Materials Installed in An Unapproved Manner or the Omission of Fittings.	Cord as line wires	139
		Other unapproved methods	140

UMI

Installing Mercury Lighting

Problems involved in providing the necessary auxiliary ballasts—details of equipment and mounting

By W. G. Darley

General Electric Company,
Nela Park Engineering Department,
Cleveland, Ohio

BECAUSE industrial lighting with modern mercury lamps entails the use of auxiliary ballast, this system of illumination presents new problems of general interest. The user is primarily concerned because he wants to obtain the most appropriate and economical equipment for his installation. The contractor is interested because he wants to know how the various equipments should be installed. The jobber must be in a position to recommend the proper type of equipment. The power company is vitally concerned with power factors.

The 400-watt and the 250-watt mercury lamps, types H-1 and H-2, are popular examples of this type of light source for which auxiliaries are essential. But for these lamps the problem of furnishing a practical ballast is simplified because it is not necessary to provide a starting arrangement. Only a properly designed reactive ballast is essential to the satisfactory operation of the lamp. As a general rule, however, it is advisable to include some means of power factor correction with the auxiliary.

For all practical purposes, the solution for the ballast problem for the 400-watt and 250-watt mercury lamps results in equipment with the same physical characteristics. However, the electrical characteristics are such that it is not practical to operate an H-1 lamp on an H-2 auxiliary or vice versa. So because they are practically similar, the ballast equipments for the two lamps will be treated together.

There are in fact three solutions for the H-1 and H-2 lamps—an enclosed unit for either wall or pendant mounting and a core and coil unit for mounting in luminaire canopies. Also, there is a weather-proof equipment for wall mounting available in the enclosed type for the 400-watt lamp only. But in order to arrive at the relative advantages of each type of equipment, they are discussed in more detail below.

Wall Mounting. The enclosed auxiliaries are generally to be preferred for wall mounting. They are provided with angle brackets, top and bottom, to facilitate mounting on a flat surface or on racks. By mounting the units on the wall the fixture suspension point is relieved of a considerable weight factor, which means economy and added safety.

Suspension Mounting. The enclosed auxiliaries are also provided with pipe connections at both the top and bottom, by means of which the unit can be suspended adjacent to the luminaire or incorporated as an integral part of the luminaire suspension. When the unit is included in the luminaire suspension, however, care must be taken to assure that other wiring devices are sufficiently rugged to support the added weight, since the enclosed auxiliaries weigh 20 to 30 lbs. When mercury and incandescent combination luminaires are installed with the transformer pendant, holes may be drilled in the sides of the upper and lower compartments of the auxiliary and the two compartments joined with flat molding so that current can be supplied to the incandescent lamp or lamps.

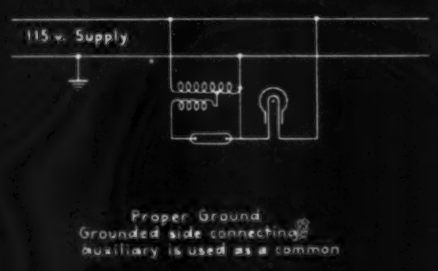
Core and Coil. Open core and coil auxiliaries are recommended for use only in luminaire canopies where size is a consideration. They have angle brackets conveniently drilled to permit easy installation.

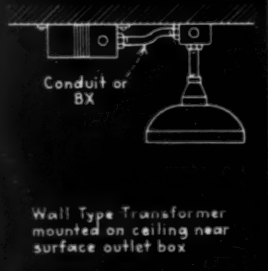
Wiring Lamp to Auxiliary. The mercury lamps may be located at any distance from their auxiliaries provided that the drop in the wires connecting the lamp and the ballast is under 2 volts. The lamps may be mounted up to the given distances from their auxiliaries, irrespective of type of auxiliary, for the following wire size, considering the runs to be one-half the length of the wire required and presuming the maximum current of 3.25 amperes for the 400-watt lamp and 4.15 amperes for the 250-watt lamp:

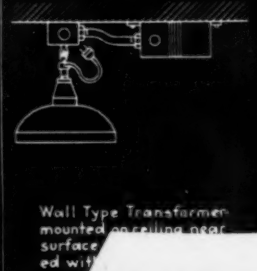
	Maximum Run	
Wire Size	400-watt	250-watt
No. 10.....	300 ft.	230 ft.
No. 12.....	190 ft.	150 ft.
No. 14.....	120 ft.	90 ft.

It is interesting to note that the 400-watt lamp draws less current than the 250-watt lamp. This is explained by the fact that the H-1 lamp operates at approximately double the operating voltage of the 250-watt lamp.

Each lamp requires a separate auxiliary from which no other load can be drawn. Naturally, the grounded side of the line, to which is connected the auxiliary and the lamp, can be used as a common. See sketch. In the event that the ground lead to the lamp is used







WALL MOUNTING—*Twenty footcandles of illumination are provided by this system of 400-watt mercury lamps and 750-watt mazda lamps. The lamps are in aluminum high bay equipment mounted 40 feet above the floor and spaced 12 x 20 feet apart. The auxiliaries are of the auto-transformer type.*

PENDANT MOUNTING—*This system, providing 20 footcandles at the work plane, consists of 400-watt mercury lamps in high bay units. The units are mounted 42 feet from the floor and spaced 15 x 18 feet apart. The transformers are pendant mounted and provide power factor correction.*

as a common, it should be of proportionately larger wire.

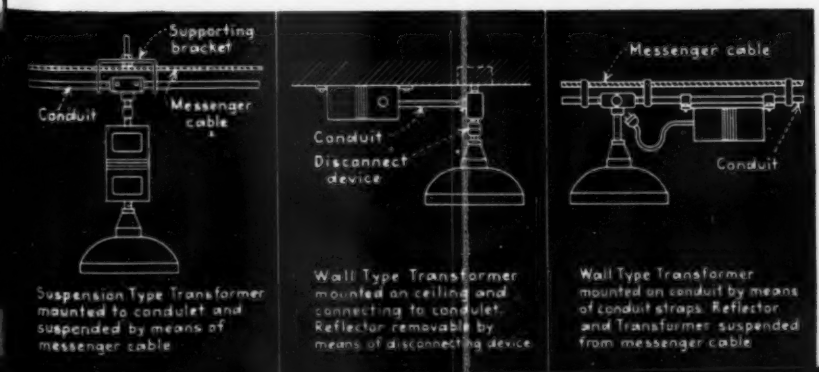
Power Factor. The enclosed type auxiliaries are recommended as a rule with power factor correction. Corrected auxiliaries result in an overall power factor for the lamp and ballast of .90. If uncorrected equipments are used, the overall power factor for the 400-watt lamp is .60-.65, and for the 250-watt lamp .45-.50. By using corrected equipment the supply lines and devices are relieved of an unnecessary burden, better voltage conditions result at the lamp, and economies in operation and installation are achieved. To emphasize this point, the comparative currents drawn by corrected and uncorrected units are shown for the H-1 and H-2 lamps in the accompanying table.

Voltage	400-watt lamp			250-watt lamp		
		Current			Current	
	Power Factor	Starting	Operating	Power Factor	Starting	Operating
230.....	.90-.95	3.7	2.1	.90-.95	2.0	1.7
230.....	.60-.65	5.3	3.1	.45-.50	3.8	3.2
115.....	.90-.95	7.6	4.1	.90-.95	3.4	3.1
115.....	.60-.65	10.3	6.2	.45-.50	7.2	5.8

From the above figures it is seen that the uncorrected installation will draw 50 to 80 per cent more current than the corrected one. In general, unless other means of power factor correction are used, low power factor auxiliaries are not recommended.

When low power factor units for the Type H lamps are used in combination installations, the overall power factor will be better than that of the transformer alone and lower than that of the incandescent lamps alone. For instance, the overall power factor of a combination unit using one 250-watt mercury lamp and one 500-watt mazda lamp is .685, and for a unit using one 400-watt mercury lamp and four 200-watt mazda lamps is .825. While these power factors are better than those for the mercury lamps alone, the fact remains that excess currents would be drawn, which would not be the case if the units were power factor corrected.

[Continued on page 29]


Supporting bracket
Conduit
Messenger cable
Suspension Type Transformer mounted to conduit and suspended by means of messenger cable
Conduit
Disconnect device
Wall Type Transformer mounted on ceiling and connecting to conduit. Reflector removable by means of disconnecting device
Messenger cable
Conduit
Wall Type Transformer mounted on conduit by means of conduit straps. Reflector and Transformer suspended from messenger cable

BALLAST TECHNIQUE—*Here at the left, are a few typical methods of installing ballast equipment in factory areas, showing the simplicity of installation.*

UMI

INTERCONNECTION CABINET—*Showing fanning terminal and battery strips on a multiple cable job.*

Handling Multi-Conductor C

Advantages in Low Tension Systems—The Technique of M

By Albert A. Schuhler

SINCE many low-tension systems are made up of a large number of circuits, the use of multi-conductor cables is growing. It is not only economical, but a more workmanlike method of installing a large number of wires. In fact, it is recommended that cable be used wherever more than three or four wires are required in a circuit. And, of course, in addition to the regular number of wires required to operate a signaling system, spare wires should be provided for any possible future emergency or expansion.

Braided cable may be used in dry locations. Lead covered cable must be used in damp or wet locations. For elevator signal and telephone systems, cotton insulated cable may be used in dry locations, but rubber insulated cable is needed in damp locations.

The telephone field has for many years employed cable with increased success. The signal field is profiting by this example, and is steadily following in this same course. Systems in which multi-conductor cables may be used include—

1. Annunciator systems.
2. Call bell and buzzer systems.
3. Elevator signal and telephone systems.
4. In and out staff systems.
5. Intercommunicating and switchboard type telephone systems.
6. Nurse call systems.
7. Paging systems, silent lamp type.
8. Program bell systems.
9. Watchman recording systems.

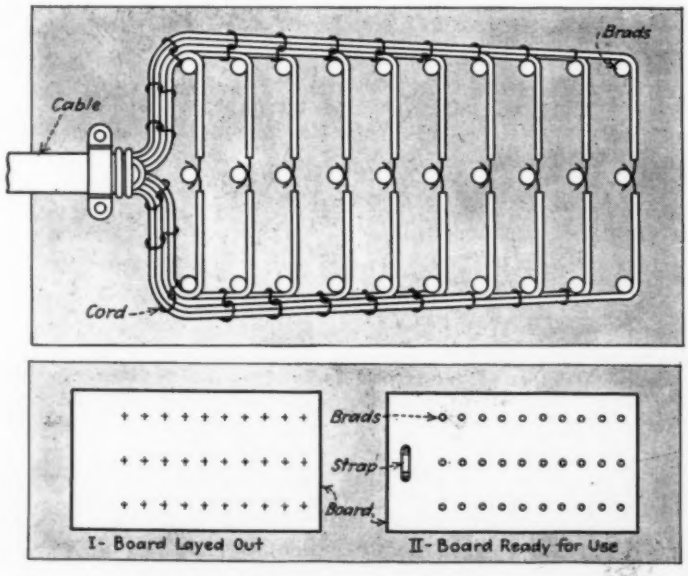
Cables are particularly advantageous between all points where the same number of conductors are to be installed. They may also be employed in some instances where the number of conductors decrease slightly from point to point, using different sizes of cable from one location to another. In places where there may be a large decrease in the number of conductors, however, it is still considered best to use single-conductor, color-coded wires.

The relative merit of multi-conductor cables and individual wires may readily be established by considering the labor costs involved in the two types of installation. It is only necessary to pull cable into raceways with a snake. In many cases short runs of cable may be pushed through the raceway without any further aid. With individual wires, it is first necessary to reel off, measure and lay out the many wires.

Testing is reduced to a minimum also when cables are used. But as a matter of precaution, all conductors should be tested before and after the cable is installed. Defects are found occasionally in the conductors of cables, using small wire, such as No. 22 B & S gauge. Since the conductors have color-coded braids, however, it is an easy matter to test the different wires. Individual wires, on the other hand, are not obtainable in a large variety of color-coded braids. Therefore, there is a duplication of colors which requires extra testing and tagging.

The size of raceways may be considerably reduced by the use of cables, as they are in themselves very compact. Also, where surface wiring is necessary, cables present a much neater appearance than individual wires. They may also be easily concealed by running them along or behind moldings in rooms.

Interconnection cabinets should be used at all distribution centers, on all floors of a building, at the bottom of risers, between a main and a branch cable. They should also be used for terminating cables at or near large



LACED CABLE—(*Right, above*) *Showing wires twisted around the forming brads and permanently laced.*

CABLE FORMING BOARD—*Marked out and drilled ready for fanning a multi-conductor cable.*

UMI

CABLES

of Making Connections

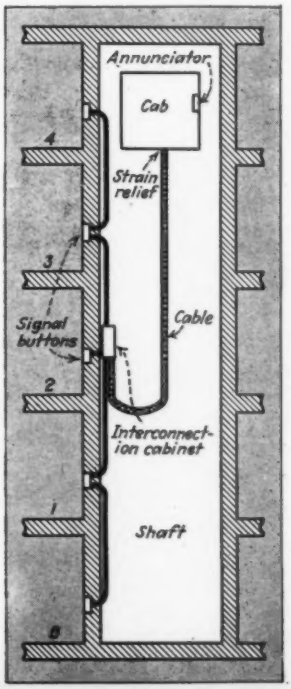
control apparatus such as annunciators, pushbutton boards, switchboards and watchman's recording desks. Likewise, these cabinets should be used wherever a cable is brought from the outside to the inside of a building.

In removing the lead sheath from cables, it is only necessary to make a slight cut all around and approximately half way through the lead. This outer covering may then be broken off, at the point of the cut, by moving the lead shield back and forth. When it is broken through, it will slide off by pulling. Should the covering not slide off easily, as is occasionally experienced with cables comprising conductors that are saturated with wax, apply a little heat along the lead covering with the flame of a candle or torch.

A schedule sheet or chart should always be made up showing every terminal on the interconnection strip, with its respective number and color code. Such a plan enables several teams of wiremen to work at various locations on the system.

A standard telephone cable color code is obtainable in textbooks and catalogues for telephone work. This should be followed in making connections to interconnection strips. Most manufacturers of these cables have a standard and uniform color code up to approximately 80 single-conductor or pair-conductor cable. Beyond this size there is a difference, and it becomes necessary to complete the coding of the remaining wires with a plan conforming with the basic color code scheme.

Where twisted pairs are used, such as in certain telephone systems, the wires must not be separated, as they are twisted in that manner to avoid inductive disturbances. Telephone cables having single conductors may also be arranged in line with the standard code. The color coding of multi-conductor cables for signal work is not entirely standardized and may, therefore, be arranged to suit any plan, as long as it is carried uniformly throughout the system.



ELEVATOR CONNECTIONS—*Detail of a typical elevator cable installation.*

Fanning and Lacing

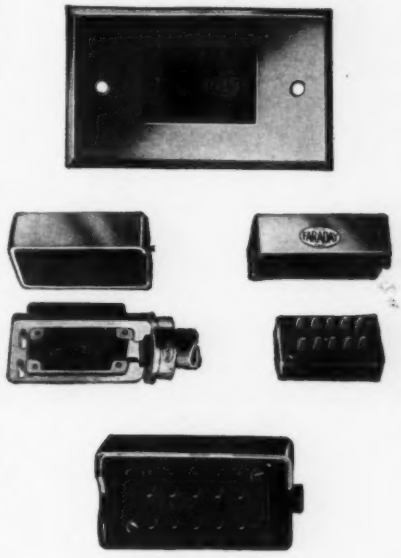
After the schedule sheet has been completed, the cable should be layed out on a board for fanning and lacing. This is done in various ways. An example of one generally used method is shown in the interconnection cabinet picture. This cable-forming board is marked out for the necessary terminals. Each outside horizontal mark is made at a point where a wire is to be brought to a terminal, and the space between them will be the same as between the terminals of the interconnection strip.

The vertical distances between the outside marks will be determined by the size of the block on which the terminals are mounted. Brads are driven in at the points marked, and the cable is laid out flat on the board against the brads. The wires are then brought out from the cable in proper order and are twisted around the center brads. They are finally stitched with lacing twine to hold the wires permanently in position.

When the cable is in its final position, cut the conductors about one inch beyond the length required to reach the terminals. Then remove the insulation of each wire about one inch from the end. This is usually done with a sharp knife, or by squeezing the insulation with a pair of flat nose pliers. If sufficient pressure is applied, silk and cotton or cotton insulation can be removed with ease. After the insulation has been removed, the cable is taken off the forming board and connected with the terminals. A coat of clear shellac should be applied to silk and cotton or cotton insulation to prevent the insulation from fraying.

Wires should be cut off closely to the terminals. Otherwise they may touch other terminals and cause short circuits and crossed wires. Where several wires are to be fastened to one terminal, they should be separated by washers. Two different colored braided wires must never be connected together, as this would defeat the purpose of color coding.

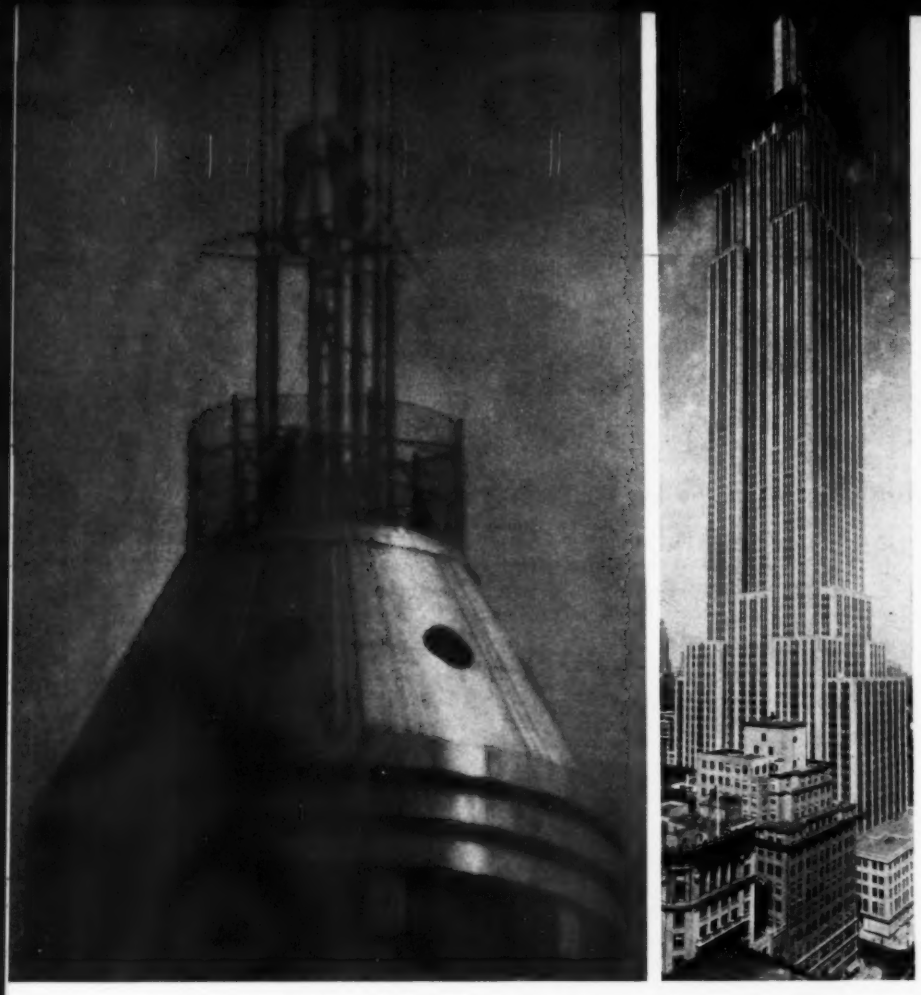
Fanning strips may be used in conjunction with interconnection strips, as they permanently separate the conductors of cables, and also provide a neat method for connecting to binding nuts or terminals. Moreover, the use of fanning strips eliminates the necessity of lacing cables.



SEPARABLE CONNECTORS—*Flush and floor type separable connectors to attach a portable signaling control device.*

Separable connectors may be used in most places where it is desired to effect a connection between the permanent wiring system and a portable signaling or control device. These may be obtained in various forms.

For elevator annunciator and telephone systems, flexible cables must be used. Here it is necessary to place the interconnection or cross-connecting cabinet midway up the elevator shaft. At this point all wires terminate from the push buttons in the system. Likewise, the flexible signal cable is terminated at this point and its conductors lead to the apparatus in the elevator cab.



IN THE SKY—*Bush installed the broadcasting equipment at the top of the Empire State Building. Here are his men putting up the gear that is now broadcasting television experimentally. This picture was taken from the tip of a pink cloud.*

Looking In

ONE of the first contractors I ever met in New York City was A. Lincoln Bush. This was soon after the French and Indian Wars. I joined the Jovian Order and the local Electrical League about then and found Bush a leader in industry cooperation. He was on all the committees and did most of the work, and as far as I can see, is still doing it. I have watched him and worked with him on many occasions and marveled that he could devote so much time and energy to association work and still run a business.

Bush was born in Watkins Glen, upstate New York, just fifty years ago. He came to Manhattan in 1896 and graduated from school four years later, headed for college and the law. But his family ran into financial troubles and Lincoln had to get a job. He applied to Ralph A. Belmont of the Belmont Electric Co., and that was a joke. Out of 137 in his graduating class he had been the only one who refused to study electricity. He didn't like it.

But somebody sent him to Belmont and Belmont turned him down. Bush was small and freckled, with flaming red hair in those days, so Belmont said, "No." But he didn't know that Linc just naturally doesn't stay turned down, and when the selling was over he told the boy to start work Monday but first to get some long pants. Linc began by running errands, straightening cable, helping in the stock room. But before long he sold Belmont an idea for an office order system and worked it out and got it running.

Belmont had seven branch offices and next year this fifteen year old kid was sent to one after the other, to systematize them, and was then put in charge of the branch at 75th Street and Madison Ave. This was up in the section where the wealthy people had their homes, and Bush built up the business of his branch by being Johnny-at-the-rat-hole for the rich. When he fixed their bells, he sold them a better push button and got a contract to maintain the batteries. When he fixed their lights, he made their wiring more convenient. When they went to the country in the summer, he had everything tuned up in shape when they got home.

Fast Moving Feller

At sixteen he was made assistant foreman, at seventeen foreman, then assistant superintendent and at eighteen, assistant to Belmont. At nineteen he became assistant general manager of the entire business, which now included fixture manufacturing. At twenty he was appointed secretary and treasurer of the company.

And all this time he had been battling to overcome the natural obstacle that his youth, his size and his red hair encountered. He saw that the only way he could get ahead was to know the business better than the other fellow, to get more ideas and to do more work. And so he stayed on the job about five nights a week. He studied and planned and tried things out. One by one he got into each function of the business. He dug into the stock room and worked out better methods of buying, inventory, issuing and delivering materials. He studied bookkeeping and cost accounting, estimating, insurance and selling. He learned this trade as apprentice and helper and up, and he found out how to get along with men and handle them.

Belmont kept on expanding until they had two fixture factories, a plant making outlet boxes, switches and reflectors and ten branches for the contracting business, scattered from up the Hudson to down the Jersey shore. Then later in 1912, they closed up the branches and concentrated their business in New York. Soon Belmont was handling the manufacturing, export and inventions and Bush running the contracting. He

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Second in a Series of Informal Visits to Interesting Contractors

On Lincoln Bush

By Earl Whitehorne

A. LINCOLN BUSH

now had a third interest in the business and in 1920 acquired a half interest. In 1923 he bought out Belmont and was sole owner of the contracting business.

Meanwhile, Bush had been gradually shifting from residential work to industrial and institutional construction. He saw the drift from homes to apartment living. He had an idea and he has followed it consistently—to see what is coming, to study it in advance and be ready to capitalize the opportunities it may bring. He became interested in dental uses of electricity. He experimented with individual drive in factories, when that idea came along, and installed a lot. He has done work for the public utilities.

Radio and Television

In the same way he got into moving picture work, and sound equipment and then radio and began to specialize in it. He took Alexander Fisher into the firm, an outstanding radio and sound engineer, and they have steadily gone forward in this field, installing broadcasting stations, as well as lots of special work for R.C.A. From there it was a natural step into television and when the time came to put this new art to the test, it was Belmont Electric that installed the first station for broadcasting pictures in the high tower of the Empire State Building. Bush is the only contractor who has ever done a job 100 stories above the ground.

Now there are two companies. Belmont Electric of which Bush is president, does electrical contracting work for theaters, banks, churches, hospitals, hotels, fraternity buildings, broadcasting studios and factories. Commercial Radio-Sound Corp. is distributor for R.C.A. of sound equipment for audition studio, public address, sound truck, school, hospital, church and non-theatrical sound motion picture equipment. Commercial Sound Radio gives out electrical work to other contractors as well as to Belmont. Fisher is president of this company and Bush is treasurer.

Men Stay With Him

Their main office is at Lexington Ave. and 51st St., with a shop on East 47th Street. Bush carries from forty to fifty people on the pay roll with three job superintendents, who engineer, estimate and supervise, and twelve working foremen and the man in charge has been with him more than thirty years. And this is characteristic of Lincoln Bush. His men have always meant far more to him than his money. His organization now averages more than twenty years in his employ.

And, in a word, that has been the keynote of this man's career. Linc likes people. He likes to work with them and for them, to promote cooperation and progress. And people like Linc. And since he gets results, they're glad he feels that way. So from 1916 on, Bush has given a large part of his time to industry, fraternal, charitable and civic work. He enjoys it. He is good at it.

Bush was one of the early members of the National and New York State contractors associations. He is chairman of the local Independent Electrical Contractors Association and had a lot to do with merging it with the Associated Electrical Contractors group. He was drafted to head the Associated's Survey Bureau and gave much of his time to it for three years. He is now on the executive committee of the National Electrical Contractors Association, representing New York and New Jersey. He is chairman of the New York State association. He is vice president and one of the founders of the Electrical Association of New York and chairman of their contractor's group. He is a director of the Electrical Board of Trade Bureau of Adjustments and of the National Electric & Radio Show. He is on the executive committee of the New York Electrical Contractors Association and on the legislative committee of the Building Trades Employers Association, and a lot more.

Linc Bush is just naturally a jiner. He is a Past District Deputy Grand Master of the Masonic Order, 32nd Degree Scottish Rite, a Knight Templar, a Noble of the Mystic Shrine, vice president of the New York Lions Club. He is an honorary member of the Mounted Police of Greater New York —God knows why—but I'll bet he tames their horses for 'em. Wherever there is a job that needs doing there you find him. Wherever there is a meeting trying to promote good fellowship, cooperation and the advancement of the electrical industry, you'll probably see him sitting up front.

When the British sailed away from New York, at the end of the Revolution, they nailed their flag to the top of a tall pole in Battery Park and greased it as they came down. Outraged at this bit of farewell nose thumbing, an ancestor of mine, John Van Arsdale, put on his sandpaper pants, shinned the pole, tore off the Union Jack, tacked up the Stars and Stripes, and slid down again, striking sparks at every knot, while dogs barked and women swooned and the band played "Annie Roonie." If Linc Bush had been there, Van Arsdale wouldn't have had a chance. Linc would have been up that pole ahead of the British, with a patent nail puller in one hand and a can of grease-soap in the other.

UMI

STRONG EVIDENCE—*This hotel installation also received a face lifting. They photographed it before and after and now use it to sell other old hotels.*

"Horrible Example" Approach Brings in Business Through the Mails From Out-of-town Owners

PICTURES

SELL

SELLS WITH PICTURES—*Harry Y. Fowler, at 24, helps his father T. Clark Fowler sell good wiring jobs by the simple use of photographs to show how rewiring benefits.*

EVERY contractor is proud of a good looking wiring job and occasionally takes photographs to show how it was done. The Reserve Electric Company, of Cleveland, goes a step further by taking pictures, before tackling a horrible example, and then photographing the completed job.

Having done this consistently for some time, a considerable number of such photos have been accumulated. These before and after sets now provide a valuable sales tool for this company, which is very active in all sorts of modernization and rewiring work. Local

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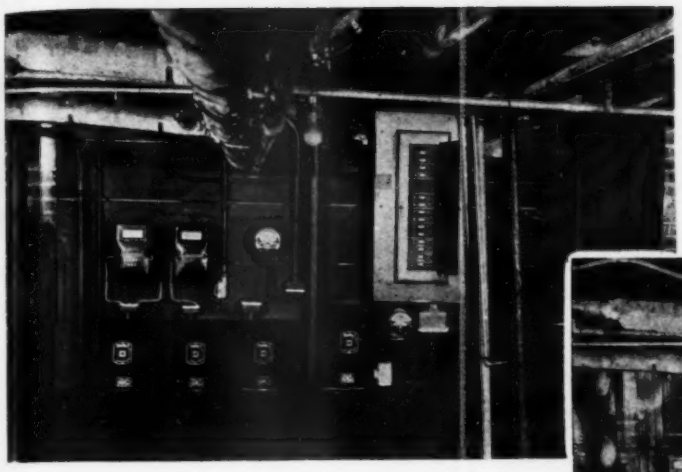
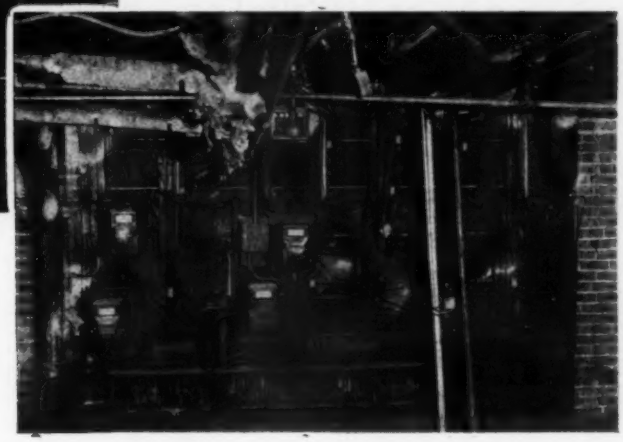




PHOTOGRAPHIC ARGUMENT—*An apartment house with 86 suites has seven of these meter centers. All have now been cleaned up and pictures show the contrast.*

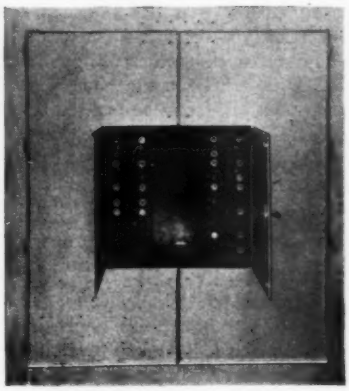
LLRE-WIRING

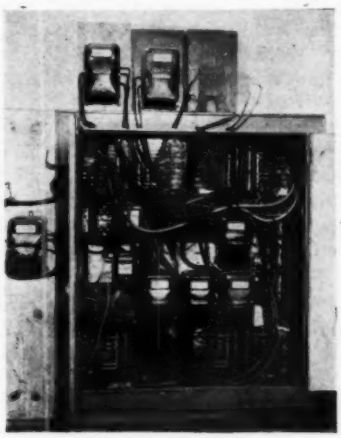
owners are shown photographic examples of how other messes have been cleaned up and made safe. But what is more important, out-of-town owners get a better idea of their own problems and are being sold through the mail.

Recently Harry Fowler, vice president, has begun taking "before" pictures with his own new camera. These photos are sent out with proposals, as evidence of the actual conditions that need fixing. The job may be an obsolete apartment house meter board, an overloaded office building switchboard, or some dangerous equipment in the meter room, for a group of stores. Sometimes the property is owned locally but the owner does not have time to see the conditions personally. Often an out-of-town owner has a local agent who must forward bids for approval. In either case, the actual-conditions picture tells its own story.

The advantage of having a variety of completed-job photos on hand comes in that they can select one that will closely resemble the prospective job in appearance. Such a photo is submitted with the "horrible example" photo, to show the striking contrast between obsolete and modernized wiring equipment.

Here then is a company that follows up the work of reinspection crews, insurance company citations of hazards, and recommendations of power company men, to do a good clean-up job. They realize that long, hard-to-read proposals and pencil sketches are uninteresting at their best. The secret of closing up many desirable clean-up jobs is attributed to showing the customer the evidence in carefully selected photos. Remote-control selling is made possible by pictures.





DOCTORING BUSINESS BUILDINGS—*The mess of haywire, at the left, was combed out for this customer and divided into the bank of meters shown on the opposite page, and an orderly arrangement of branch circuit fuses in the old box. And the job was sold by means of pictures.*

UMI

They Like

Comments on Our Suggestion on "The Way To Sell Wiring"
Contractors, Power Companies, Manufacturers, Wholesalers Endorse
The Plan to Quit Preaching to John and Mary
and Show Them That Their Wiring Is "Lousy"—
It Worked with "Better Sight"—It Will Work Here

LAST month we suggested a way to sell wiring—a new way. It is a simple idea—to go into the house with a gadget just as we did in the Better Light-Better Sight Campaign. With this gadget you will check voltage drop and insulation leakage and show John and Mary how bad their wiring is. The gadget, of course, will not read in volts or megohms, but indicate in percentages and show up good or bad conditions.

You will show how voltage drop, caused by tight wires in the house, reduces the brilliance of lamps, slows down the toaster, percolator and other heating appliances, wastes money and kills comfort. You will point out that leakage is risky. You will sell some extra circuits to correct these troubles and provide long needed extra outlets. You will quote a price in easy payments, just a few dollars a month. And John and Mary will be glad to buy.

It is an interesting plan. It is as smart a sales approach as the use of the sight meter to sell I.E.S. lamps. It should be no less successful—if the industry will get behind it. The technique of demonstration is simple enough.

Interesting comment is already coming in from contractors, power companies, manufacturers and wholesalers about the country. Here are a few quotations from letters received, as this issue is about to close—

1. *From an Ohio contractor*—"I am happy to say that I think your article on "The Way To Sell Wiring" and your idea of tying it up with the "Better Sight Campaign" is certainly the foremost idea in this respect that I have ever read. You have a real selling talk in a story form that will work IF you keep on for at least six issues of the magazine. I can assure you that our association will profitably spend at least one evening discussing your new method of selling wiring."

2. *From a Texas contractor*—"This article will be very valuable to the sales end of the electrical contracting industry. A lot of hard work has been put in by one who understands in no small measure the problems of our industry. Such expressions as "Tight Wires," "Full Comfort Wiring" are styled in new phraseology for the industry in these parts, but are so readily grasped that I am sure it will be resounded throughout the nation by the Qualified Electrical Contractors. You should see immediate response all down the line."

3. *From a Rocky Mountain power company*—"I am not going to place myself in so vulnerable a position as to try to offer any further comments on your reprint entitled "The Way to Sell Wiring" than to say this is indeed hot! It is the finest thing I have seen in this connection. I am passing this suggestion along at once to our all-industry organization. We are certainly going to town on this idea."

4. *From a Wisconsin utility*—"I believe you have something. I like your expression "Full Comfort Wiring" and with your permission I would like to promote the use of it in our territory. 'Adequate wiring,' 'convenience outlets,' and all the other expressions we have been using in the past seem ineffective and we need some terms which will create a spark of interest in the minds of Mr. and Mrs. Home Owner."

5. *From an Illinois utility*—"The plan you suggest to sell wiring is excellent and should be the means of stimulating a lot of companies to activity in this field. It is rather surprising that the subject of promoting the sale of adequate wiring has remained stagnant during the past few years, and it is very timely to arouse all interests in a program aimed at increasing wiring facilities, especially in the home. With the constantly increasing sales of appliances and portable lamps, it is apparent that there is a need in the home of the customer for proper facilities, so that such appliances can be used most advantageously."

6. *From a Connecticut power company*—"You have a new approach in selling the wish for more wiring instead of selling the wiring. Perhaps it

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The "Gadget" Idea!

will work, and perhaps a simple 'gadget' can be devised to demonstrate the inadequacy of present wiring."

7. *From a Middle West power system*—"Perhaps it requires a gadget to stimulate the interest of the prospect for additional wiring to the point of purchase. Such a gadget should certainly help in getting interest. However, it seems to me that what is required, and will work with or without gadgets, is something that will stimulate the interest of our industry, contractors and central stations both, to put forth enough effort to take an intelligent story on adequate wiring to our customers. It would probably be easier, as with most other selling, were a time payment plan available for the purchase of wiring. The sale of additional wiring as a joint activity for contractors and utilities offers a splendid way of bringing these two groups closer together for other activities."

8. *From an Illinois utility*—"I don't think your plan is one bit 'cockeyed.' On the other hand I think 'you've got it.' The next thing is to get the right equipment to carry out the work."

9. *From an Eastern manufacturer*—"I think you have hit upon a real thought and a very constructive one. This approach to the sale of adequate wiring will have much more opportunity in the hands of the American public than that approach used heretofore."

10. *From another manufacturer*—"It undoubtedly has merit, and would require considerable organization to put it over. This might be obtained through member companies in NEMA."

11. *From another manufacturer*—"I believe you have the answer and one which will help us all. The 'gadget idea' appeals to me very much."

12. *From another manufacturer*—"I found it very interesting, and was certainly glad to see Electrical Contracting go into this matter so actively."

13. *From a national wholesaler*—"The more I think of your plan the more I think of it."

14. *From another national wholesaler*—"You are on the track of a practical method of bringing this question of adequate wiring home to the house owner in a way that will make him appreciate what it means and will make him want it."

15. *From another jobber*—"Your article seemed to me to be a very practical bit of writing as well as furnishing some very valuable ideas. The idea of the gadget and the financing of the installations described by you certainly merit serious consideration. We shall all hope that—'You've got it'."

* * *

Electrical men are rarin' to go on this job of rewiring the 22,000,000 already built homes, where further use of electric appliances and light is so badly blocked by inadequate circuits. They realize that the 2,000,000 new dwellings now to be built ***must be*** wired for "Full Comfort," if we want to make a larger enjoyment of electricity popular any time soon.

All we need is a merchandising plan, so we can quit just telling John and Mary what they ***ought to do.*** We want to sell 'em! We want to start selling 'em now! Well here is a plan—let's use it!

If you have not read it—look up your copy of Electrical Contracting for April. Or—write for a reprint of the article—"The Way To Sell Wiring." With it you will receive also the analysis of "What Full Comfort Wiring Costs," which shows that wiring ***does not cost too much*** when figured into the ordinary monthly bill for financing the new house.

When you have read this story, send in your comments and your criticisms. What shall we do about it?

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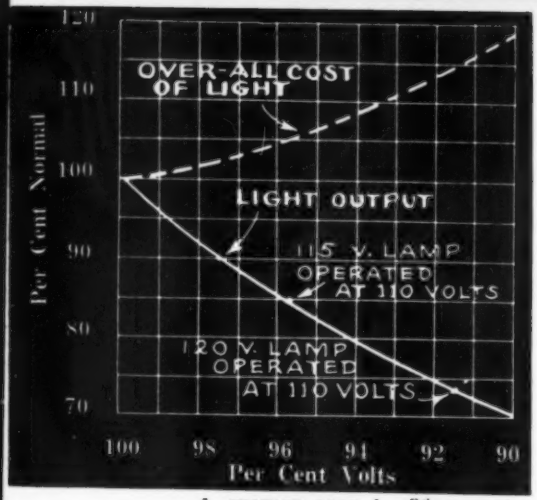
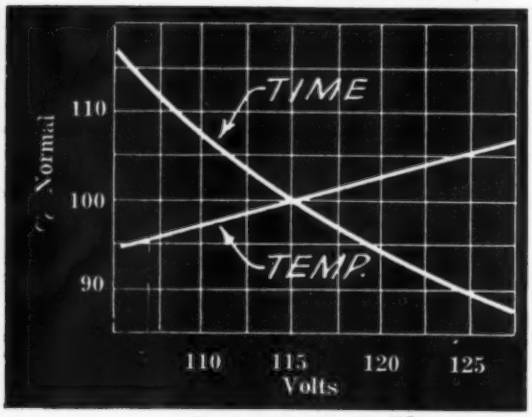
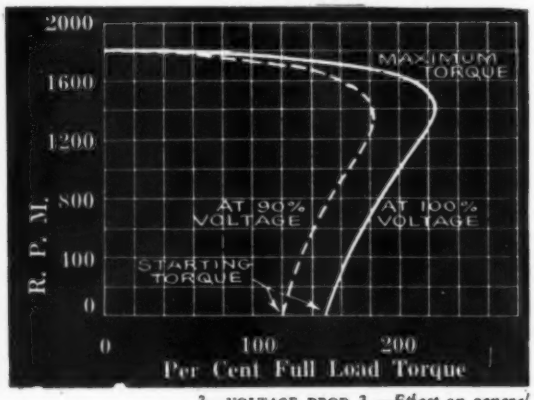

OVER-ALL COST OF LIGHT
LIGHT OUTPUT
115 V. LAMP OPERATED AT 110 VOLTS
120 V. LAMP OPERATED AT 110 VOLTS
Per Cent Normal
Per Cent Volts

1—VOLTAGE DROP 1.—*Effect on performance of incandescent lamps.*



2—VOLTAGE DROP 2.—*Effect on operation of range surface units.*



3—VOLTAGE DROP 3.—*Effect on general purpose induction motors.*

SO FAR some 26,000 copies of the new Handbook have been sold. You probably received one, and have read it. But it won't help you much unless you use it—day by day. That's what it is for. Because some of the practical utility of this Handbook is not apparent at first glance, Mr. Slauer has been asked to discuss it section by section and point out its practical value.

How to Use

By Richard G. Slauer

Westinghouse Lamp Company; Secretary, Industry Committee on Interior Wiring Design

ALTHOUGH lighting is not the exclusive element of a wiring system that it was in 1880, it still remains the most important, from the standpoint of general planning. It is used in every interior space. It is always installed as part of the building. The number of lighting outlets in any interior far exceeds the number of power outlets. The wiring, for a piece of motorized equipment, costs far less in proportion to total cost than the wiring for a lighting installation. Therefore wiring changes, after a building is erected, meet more resistance.

Recognition of these points will explain why there is a separate section on lighting in the Handbook of Interior Wiring Design. Power and heating loads are important, but to the wiring designer they imply only horsepower rating, type of device, and method of control. Thus the feeder and general network system is the major point of design. But for lighting, the architectural features of the building must be studied, the eventual use of a space must be determined to a certain degree, and the desired general effect must be known. Not only is the feeder and panelboard network system important, but each individual branch circuit must be carefully planned.

Lighting Design

The lighting section of the handbook is not a complete treatise on illumination, however, it is a general survey which covers the elementary design of outlets and the background factors which make lighting units good or bad. But outlets are not the only part of a wiring system—branch circuits, circuit control panelboards, feeders, and service equipment are all essential parts. Definite standards for these are carefully stated.

One of the more important tabulations is the list of standard loads for all types of occupancies, expressed in terms of watts per sq.ft. as well as foot-candle intensities. These are not maximum values, but in most cases, merely the values of those jobs being installed, which are considered satisfactory. Only for a few notoriously underlighted operations is an attempt made to raise existing levels.

Because ceiling heights, interior sizes, type of occupancies, and other details vary so greatly, it may be doubted that general standards could ever cover every factor. Those who compiled the handbook make no such claim, although they have packed into these few pages a wealth of material and experience. Naturally the standards presented represent average opinions, but it is surprising how many decisions were unanimous.

One, of particular interest to the contractor, is the unanimity of opinion regarding the requirement of at least #12 conductors for all branch circuits. The code almost everywhere still allows #14 wire. It is perfectly safe even when loaded to capacity. But it provides no flexibility, allows no expansion and cannot supply ordinary lighting loads, without serious voltage and copper losses. It is possible to cut down our loading for #14 wire to such a point that these last two items are less harmful, but this would only emphasize the first two. Also, if protection through lower than 15 ampere rating has been attempted, a simple change of lamp size or even in fuse or circuit breaker, will quickly nullify this policy.

After the standards, conditions of adequacy for power wiring are provided in the handbook. The National Electrical Code is much more specific in providing a margin of safety for power loads than for lighting loads. This is largely due to the normally higher starting currents, and the possibility of higher currents due to recurring overloads. Therefore, it is often

The Handbook—2.

Here is practical help in laying out commercial and industrial lighting. Simplified Procedure. New Wiring Symbols.

assumed that minimum wire sizes are satisfactory. But, as in lighting, distance affects voltage and copper losses, without affecting safety, and these are just as important to the achievement of rated service. Roughly speaking, a 5 hp. motor, operated 10 volts under voltage, is no better in its performance than a 4 hp. motor operated at voltage.

Procedure in Design

But all of the facts presented in the standards are of little value unless they can be put to work. Therefore a separate section of the handbook has been prepared, called the "Procedure." A small store-office building is assumed; and step by step, the layout of individual outlets is made, then of branch circuits, the feeders, and the rest of the network system. The procedure is one form of explaining the standards in detail; and these additional paragraphs make it of even greater value. Naturally the man, who is making layouts every day, does not need this step by step method, but to those who are seeking to expand their work, it offers an exceptional opportunity.

Similarly, a procedure for power layouts is presented. No particular example is assumed, since the material can be explained as satisfactorily in a general way. It may be noted, however, that the need for ingenunity and experience on the part of the contractor would not be ended by the printing of millions of copies of the handbook, any more than the printing of the code for 40 years has done so. Both provide basic concepts—onef or safety, the other adequacy.

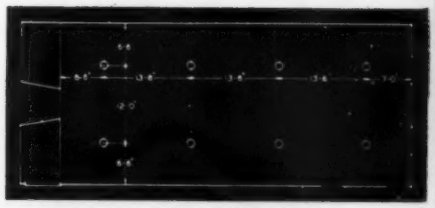
There is ample scope "within the rules" to provide extra safety, extra adequacy and extra effectiveness for the consumer. But the ability of any one contractor to do these things better and at a lower cost than any other contractor will continue to be the factor that makes him a success.

New Wiring Symbols

All wiring problems require certain elementary data. These are listed in the handbook, so that for basic problems, additional reference books need not be consulted. A distinct aid is the presentation of new wiring symbols for architectural plans. Those formerly used were losing their value, because of the many new methods of applying electricity, and the present emphasis on the flexibility and simplicity of symbols. Contractors should be particularly interested in the new symbols, since it was their representation on the Handbook Committee, which was most active in asking for a change and working to make that change of greatest benefit.

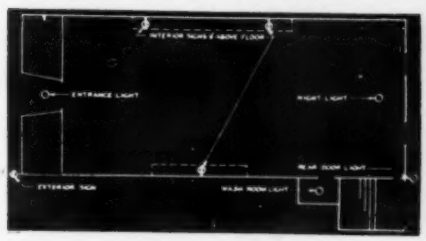
But having laid out a job which may be considered entirely satisfactory, how can the customer be convinced of its value? We would only be imitating the ostrich, which buries its head in the sand, if we did not recognize that the initial cost of an adequate wiring installation is invariably higher than an inadequate one, although not necessarily higher than an inefficiently designed layout.

Here the handbook offers two aids—the definite facts and figures, as presented in the technical section of advantages, and the less tangible but equally important fact that you can back every step of your layout by referring to your use of the handbook as an authority. Unlike the code this use bears no legal status. It probably never will. But it bears the approval of the industry's leading organizations. It is already recognized as an important addition to the mental tools of the contractor. It proclaims its aims and its standards, but it also explains on what these are based. The handbook will bear the full scrutiny of the seller, buyer, designer, or consultant on matters pertaining to wiring.

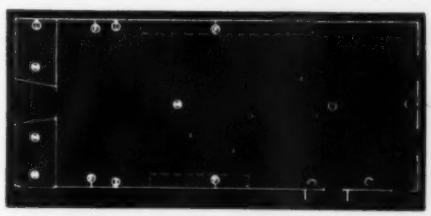


4—STORE BUILD-UP 1.—*Locating outlets for general lighting.*

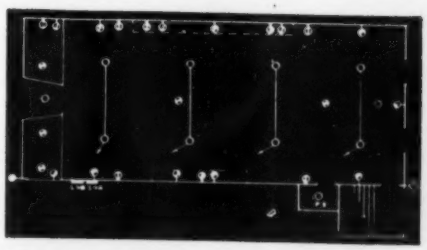
5—STORE BUILD-UP 2.—*Locating outlets for window and cove lighting.*



6—STORE BUILD-UP 3.—*Locating outlets for miscellaneous lighting.*



7—STORE BUILD-UP 4.—*Locating convenience outlets.*



8—STORE BUILD-UP 5.—*Finished layout of all outlets.*

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Variables In Labor Costs

WILLIAM A. RICHTER, *the author of this article, has seen Manhattan's skyline grow, and had much to do with estimating some of its most complicated electrical jobs, that have come with it.*

By William A. Richter
Electrical Contractors Service
New York City

THERE are several schools of thought as to the best way to determine labor costs. But regardless of the method employed, labor units only provide a guide for the estimator.

Except for such data as the larger operators have compiled from private studies and job analyses, labor units cannot hope to be all-inclusive. Each job, whether very large or reasonably small, contains some variable conditions that must be given separate consideration. It all rests with the estimator. His judgment determines how to compensate for these variables. The percentages of such compensation, whether it be to deduct from the standard units for ideal conditions, or to add to them because of adverse conditions, still rests with the individual. A formula suitable for general use has not yet been devised.

The estimator is first concerned with the primary factors that will affect his labor costs throughout an entire operation. Some of these factors may be readily determined, while others are unknown or depend to some extent upon the acts of others.

Also, there are many minor or secondary factors and conditions to be considered. Some of these assume serious proportions, however, when considerable work must be done under adverse conditions. The accompanying list of the most common of these factors may serve as a reminder or danger signal for the hasty estimator.

Since labor estimates involve considerable risks, and the results are never known until the job is almost completed, all these variables must be taken into account. Estimators should therefore make protective allowances based on previous job experience, in the absence of a formula for finding the elusive "X"-values. By facing the conditions, and exercising sound judgment, their basic labor units may become a firm foundation upon which to build with reasonable security. Guesswork and foolhardy gambling will then bow to the dictates of experience.

PRIMARY VARIABLES
Which Affect Labor Costs

A. KIND OF BUILDING
Type of construction.
Size—Number of floors—area per floor.
Floor heights—Plain factory construction, or exacting, ornate structure with panelling, marble wainscoting and furred areas.
Vacant or occupied—obstructions or crowded spaces.
High bays—Shafts—Towers.

B. WIRING LAYOUT
Simple, or typical circuits, easy to wire.
Complicated, dense layout of special design throughout.
Straight lighting only, or many coordinated systems.

C. LABOR SUPPLY
Jobs in other cities, usually requiring new crews of unknown efficiency or any job where new help will be required.
Work requiring special skill, costing more than a simple job.
Scarcity of capable mechanics that may impose double-time production.
Limited Hours—day and night shifts—throwing estimates out of gear.
Jurisdictional disputes or limitations, causing work interruptions that take their toll in lost man-hours.

D. WORK SCHEDULE AND EFFICIENCY OF BUILDER
Speedy job reducing lost motion, or "draggy" jobs that reduce efficiency and pile up excessive travelling and supervision costs.
Extra-fast jobs requiring inefficient overmanning or working at a disadvantage, while waiting for special material.
Inconsiderate general contractors, who "cover up" a reasonable-sized and efficient crew by speeding up concrete pouring, masonry or metal lathing schedules without warning.

E. OTHER CONTRACTORS
Other mechanical trades, such as the plumber, steamfitter and sheet metal contractor that may block or obstruct the electrical contractor. Here it is a question of how much to spend for keeping a man constantly on the job, in order to avoid interferences that often require costly changes.
On important jobs a special layout should be made showing the route of all heavy conduits, to coordinate them with the work of other trades. Even then this work must be constantly watched, as other trades often change their work without due notice.

SECONDARY VARIABLES
That Often Cause Major Disturbances

1. WEATHER CONDITIONS affect production. Check seasonal conditions before completing the estimate.
2. JOB LOCATION may add to travelling time, especially if the job drags along.
3. HAZARDOUS CONDITIONS cause workmen to take extra precautions. Are you covered?
4. EXCESSIVE TEMPERATURES, hot or cold, seriously affect average working results from 10 to 25 per cent.
5. FUMES OR DUST mean a reasonable pause for relief in the great out-of-doors.
6. TEMPORARY WORK goes wrong and usually gets some attention by the wiring crews.
7. SCAFFOLDING takes extra time, sometimes a lot.
8. MAKE-READY depends on the job. Study it beforehand.
9. MATERIAL HANDLING is a part of job costs. Don't expect everything to be ideal. Allow for time losses.
10. MATERIAL SUPPLIES are not always on hand. If not, the work slows up.
11. STRANGE APPARATUS invites study and conferences and your labor payroll takes it on the chin.
12. TESTS AND ADJUSTMENTS vary according to skill, supervision and engineers; and they consume man-hours.
13. PAINTING of meter boards and equipment is usually an obligation of the electrical contractor.
14. CUTTING AND PATCHING is to be judged from the average conditions of other similar jobs.
15. SPECIAL TOOLS may cause labor savings in some instances, yet their use on other jobs may add to the cost of conventional installation procedure.

ANOTHER STEP TOWARD PERFECTION

The C-H Pressure Type Fuse Clamp

For either ferrule or knife blade type fuses. Insures firm, non-heating fuse contacts. Fuses always easy to replace. Single twist of screw driver and fuse is released; another twist and fuse is locked firmly in place.

● It is more and more widely recognized that the main duty of a safety switch is to *carry* current . . . continuously, efficiently, and without trouble. That means *all* current-carrying contacts must be constructed properly. Otherwise, heating is sure to develop; and heating has but one result—*trouble.*

The Cutler-Hammer Mill Duty Safety Switch *is* designed for maximum rupturing capacity. But, from the start, it has also been designed to *carry* current with constant high efficiency—best illustrated by such famous features as the non-current-carrying hinges, silver-plated jaws and blades, and the milled clip construction.

And now Cutler-Hammer announces another step toward perfection . . . the pressure-type fuse clamp which virtually eliminates heating at the fuse ends. Thus, C-H engineering skill and knowledge make the Bull. 4101 Mill Duty Safety Switch still more dependable for industrial service. Busy factories are quick to recognize its superiority; and aggressive wholesalers and contractors feature it for its unquestioned leadership. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus.* 1306 St. Paul Ave., Milwaukee, Wis.

CUTLER-HAMMER
SAFETY SWITCHES
C-H

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There is no substitute for

Confidence

FLAME RETARDING... Will not carry flame—prevents damage to braids and insulation during soldering or sweating into lugs.

MOISTURE RESISTING... Braids and insulation hermetically sealed, by a special process, against such destructive agents as moisture, light and air. Protected against condensation in conduits. Improves with age.

FISHABLE... Slick, patent-leather-like finish—with non-migrating lubricant dressing—does not become soft, gummy or tacky—easy to pull into conduits—more wires possible in a given size conduit.

STRIPS CLEAN... Saves installation time and labor—strips freely and cleanly.

THERE IS NO SUBSTITUTE FOR SAFECOTE

LOOK FOR THE SAC
FOR YOURR

SAFECOTE PERFORMANCE SPECIFICATION VA

GEORGE C. RICHARDS, LICENSOR'S AGE 55

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Permission to use the Safecote trade-mark carries with it the obligation to produce wires and cables in accordance with Safecote performance specifications.

ACOTE TRADE-MARK
RROTECTION

ONVAILABLE UPON REQUEST

GE 55 EAST 44TH STREET, N. Y. C.

UMI

check

THE BEST WIRE FOR NEW AND OLD HOUSES

HAZARD WIRES *and* CABLES

HAZARD FIREKROME SAFECOTE BUILDING WIRES

1 Performite "super-aging" rubber insulation is tougher, stronger, and has greater life.

2 Hazard Standard 30% insulation is an excellent wire used in many outstanding buildings.

3 Hazacode (National Electrical Code Standard) is thoroughly reliable.

HAZARD FIG. 8 LAMP CORD

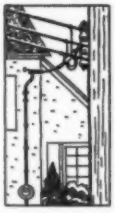
A low cost all-rubber cord with single rubber jacket. A knife nick at the end, and the conductors may be easily separated, leaving full insulation on each.

HAZARD SERVICE CABLES

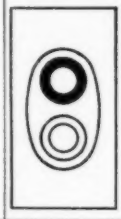
1 Hazard Drop Cable, Type SD—pole to house.

2 Service Entrance Cable, Style ABN with steel tape armor, or Style UBN without steel.

3 Underground Entrance Cable with interlocking galvanized steel armor, or Armortite non-metallic armored cable.



HAZARD PERMEX LAMP CORD



This rubber sheathed lamp cord has two separately insulated conductors with a tough rubber jacket surrounding them.

HAZARD ARMORED CABLE

Type AC. A new cable with the handy pull-string. The conductors are wrapped in chemically treated, flame-retardant, moisture-proof paper. The bushing slips between paper sheath and steel armor.

HAZARD CNX (Trial Installation Cable)

This covered neutral cable is designed for use in houses, buildings of frame construction and all types of farm buildings, including barns, garages, stables, etc.

HAZARD INSULATED WIRE WORKS

Division of The Okonite Company

WORKS: WILKES-BARRE, PA.

Sales Offices:

New York Chicago Philadelphia Pittsburgh Buffalo Boston Detroit
Atlanta Seattle Dallas San Francisco Los Angeles Washington

Installing Mercury Lighting

[FROM PAGE 13]

Wiring Auxiliary to Panel. Wiring from the panels to the auxiliaries should be of sufficient size to keep the wire losses within reasonable limits, inasmuch as operating the lamp above or below its rated voltage or current will affect the life and lumen output of the lamp. Where there is a possibility that the current through the lamp is too low due to line drop, it is well to check with an ammeter and, if low current is found, to change to a lower line voltage tap on the auxiliary.

Types of Auxiliaries. It is interesting to note that for the first two and one half years, recorded sales of the 400-watt equipment (over 24,000 units) have been divided approximately as follows:

Enclosed wall mounting...62 per cent
Enclosed pendant mounting 21 per cent
Open core and coil.....17 per cent

The 250-watt lamp has not been available for as long a period as the 400-watt lamp, and so the demand figures probably do not present as reliable a picture as those given above. For the first eight months the H-2 lamp was on the market, the recorded sales (over 1,800 units) were divided approximately as follows:

Enclosed wall mounting..42.4 per cent
Enclosed pendant mounting 17.2 per cent
Open core and coil.....40.4 per cent

Power Factors of Auxiliaries. When the 400-watt mercury lamp was first placed on the market, practically all installations went in with auxiliary equipment which was not power factor corrected. As a wider experience was gained through installations, the advisability of using the power factor corrected equipment became more apparent, until at the present time, figures show that of the total number of recorded auxiliary sales 45 per cent were of power factor corrected equipment.

The 250-watt lamp has been on the market for a much shorter time and may be considered to be going through a more or less experimental development to locate fields and applications where it may be used. In common with the 400-watt lamp in its early stages, recorded auxiliary sales show that only 21 per cent of the 250-watt H-2 auxiliaries have had the power factor corrected. It is possible that the per cent of corrected H-2 equipment may never equal that for the H-1 lamp.

EXPLOSION PROTECTION

with

APPELTON

Explosion-Proof Unilets

MDS Series Explosion-Proof Unilets

Type "EVA" Explosion-Proof Lighting Fixture (100 and 200-Watt)

Type "CPSIC" Unilet Complete with Lift Cover (Closed)

Type "GRUBE" Unilet

Type "EFSC" Motor Control Push Button Station

Type "CEST" Explosion-Proof Receptacle Equipment Complete with Type "CPH" Plug

Explosion protection is assured with Appleton Explosion-Proof Unilets. In any location where explosion gas or dust is present, Appleton Explosion-Proof Unilets protect lives and property by removing one cause of detonation. Their use also results in lower insurance rates.

Made of malleable iron, their sturdiness gives thorough protection, and the Cadmium finish resists rust.

Write today for Bulletin 1003.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY
1704 Wellington Ave., Chicago, U. S. A.

New York.....76 Ninth Avenue Detroit...7621 Woodward Avenue
San Francisco..655 Minna Street St. Louis....420 Frisco Building
Los Angeles....340 Anzua Street Atlanta...203 Luckie St., N. W.

APPELTON

Explosion-Proof

UNILETS

Reg. U. S. Pat. Off.

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THESE BOOKS SHOW YOUR MEN HOW TO GET MORE

They tell the industrial plant manager how to detect and stop losses caused by inefficient, antiquated electric circuits. Use them in your calls on power users. Both books are offered *Free* in connection with Anaconda's "Modernize Wiring" program.

EVERY industrial plant manager is interested in learning how to stop waste . . . how to obtain full value for the electric power he buys. These two books will enable you to show him. With the "Industrial Wiring Survey" you can answer his first question: "How can I find out what's wrong?" With the "Industrial Guide for the Selection of Wire and Cable" you can answer his next question: "How can I correct the trouble?"

These books will pave the way for you and your men to develop profitable wiring contracts. As you well know, a large volume of business awaits the contractor who can get wiring modernization started. Estimates show that 9 out of 10 industrial plants today are suffering serious losses through antiquated, inefficient electric circuits.

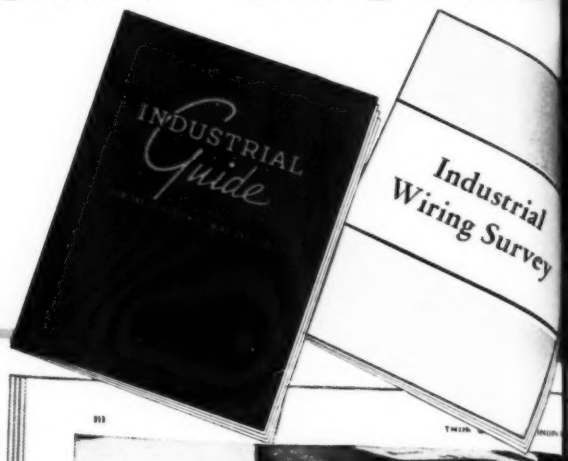
Note this advertisement on "Modernize Wiring"

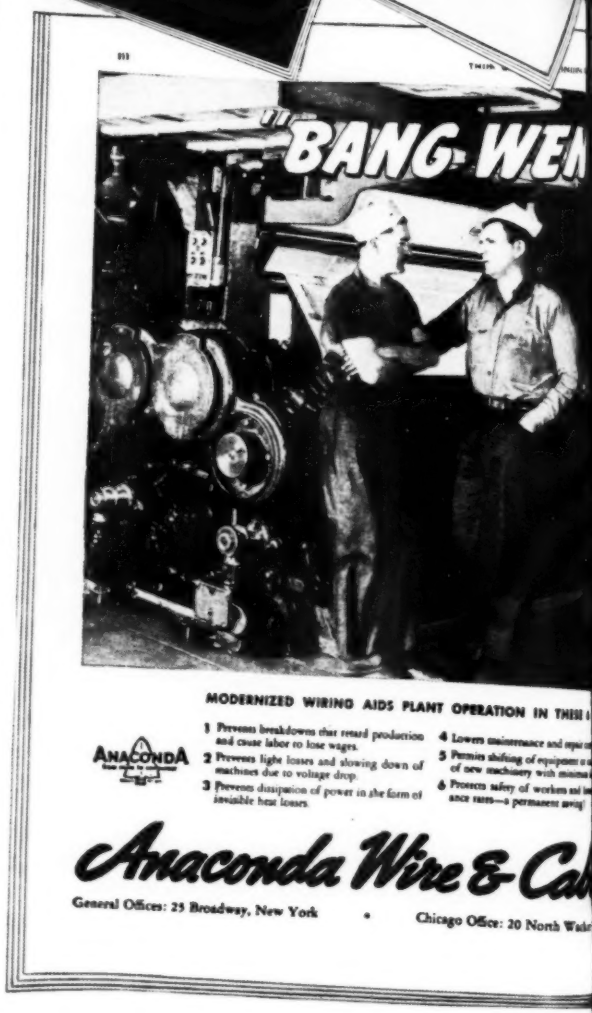
In order to convince manufacturers that they should modernize wiring now, we are publishing advertisements like the one shown here. These ads appear in *Time, Business Week,* and *Factory Management and Maintenance.* Through other ads, we are presenting the modernization message to plant engineers in various industries: coal, steel, automotive, textile, food, metal, mining, chemical, engineering . . . a comprehensive program from which you benefit if you tie-up with it.

Send for these books today. Many other electrical contractors are already using them to get business.

ANACONDA
from mine to consumer

37549A




"BANG-WEN
MODERNIZED WIRING AIDS PLANT OPERATION IN THESE
ANACONDA
Anaconda Wire & Cable
General Offices: 25 Broadway, New York
Chicago Office: 20 North Wack

Anaconda Wire & Cable

General Offices: 25 BROADWAY, NEW YORK • Chicago Office: 20 NORTH WACKER DRIV

WIRING BUSINESS

THE FEEDER...

AND THE DEADLINE WAS 3 P.M."

...glected power lines are costly! Avoid tie-... by checking electric circuits now. A wiring ...ey will cost you nothing—make one now

...ssing industry is made up of "dead-... Publications must be mailed on sched-... must meet delivery dates. No wonder ...y is dependent upon efficient electrical ...

...ines may not run on as close schedules. ...e can be just as costly. Right now, in ..., orders are causing production to be ... And high-speed operation reveals a ...ctrical engineers well know:

...f factories need to modernize wiring!

...show that 9 out of 10 plants today are ...ed by uncleared electric circuits. Even ...l breakdowns do not occur, money is ... in other ways. Power wasted through ...n one. Excessive maintenance and re-... another. Slowing down of machines ...hop drops is a third.

...e check-up of factory wiring

...in discovering and avoiding break-... make you to stop hidden losses.... ...prepared two useful books. One is our *...ring Survey*". This volume tells you how to initiate a scientific check-up of electric circuits. It simplifies the problem surprisingly.

The other is our "*Industrial Guide for the Selection of Wire and Cable*." Brand new, it is the only thing of its kind in the electrical industry. Scores of situations are described and an engineering recommendation is given for the correct wiring solution of each.

Write for these books—then put the matter up to your electrical engineer, industrial consultant, or electrical contractor. If you have a specific problem, consult our engineering department. We will cooperate without obligation.

...mpany

...s in Principal Cities

FREE! These two books will enable you to make a wiring survey.

USE COUPON BELOW TO GET YOUR COPIES

Anaconda Wire and Cable Company
25 Broadway, New York City.

Please send copy of your new "Industrial Guide." Also copy of your "Wiring Survey." (If you already have one of these books, check the one wanted.)

*Signed*_____

*Company*_____

*Street*_____

*City*_____ *State*_____

...e Company

...Sales Offices in Principal Cities

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May EDITORIALS

Earl Whitehorne . . . . . Editor

N.I.S.A.– A Good Job

Motor shop men, members of the National Industrial Service Association, recently gathered in Chicago for their annual convention. They had a good meeting—good attendance, good papers, good discussion of current shop and service problems. But the best thing about it was the demonstration of the value of this kind of cooperative work.

This group split off from NECA during the code days, feeling that they were not contractors. They have gone it alone since then. It seems a pity that there should be two organized national groups of motor shop men, far better that they should all combine under one banner—whichever it might be. But meanwhile, N.I.S.A. is certainly making a contribution not only to its membership, but to the advancement of the industry.

The motor service shop has many problems—like every other business. These issues were reflected in the program. It is a fine thing to see men tackling their troubles in this way, by sharing their experience and helping each other search for a broader knowledge. The entire motor shop field should be enjoying these benefits together.

About These Labor Pains

Men hesitate to talk very loud about labor. This has been particularly true in the electrical industry. Among the contractors we have had union and open shops. Each employer has decided which he preferred and gone his way. Long ago it was agreed that labor should not be argued about in national meetings, that national associations should keep out of it.

The open shop also has been a tradition with the electrical manufacturers—the wholesalers, too. And the power companies have remained practically free of unionization. But it looks as though those days are gone. Labor in America has split into two groups and started a civil war in support of its two champions.

Both sides are now drumming up troops. John Lewis' C.I.O. has won the forces of the General Electric in Schenectady and Lynn. William Green's A.F. of L. is recruiting among the employees of Westinghouse and Allis-Chalmers in Pittsburgh. Other drives have been reported, to organize power companies and the American Tel. & Tel., and other manufacturers. Two electrical unions are in the field—the International Brotherhood of Electrical Workers (A.F. of L.) and the United Electrical and Radio Workers of America (C.I.O.). To make this mess more merry, there are three organized groups at Westinghouse, for example, one C.I.O., one A.F. of L., and a company union. The same situation has or will come at other points. And the war has just started.

But this is not a mere something to be indignant about or to laugh over. It is a very vital and a very present problem that must be faced. It is far bigger than a row between union leaders. It apparently marks the coming of labor organization on a larger scale than America has known before. It is part of the vast social revolution that we have watched unfolding, here and abroad, ever since the World War. And nobody is deeper in it than the contractor.

The old question of closed or open shop was simple. The problem now impending is—which union? And if your men belong to I.B.E.W., what will happen if you have a construction or maintenance contract in a factory where a C.I.O. vertical union is established? Will your men be allowed to work? Or, if your gang belongs to U.E.R.W., are you in wrong with the craft unions on a building job? And, if the war spreads and more and more workers join in, as appears probable, how long can a non-union shop prosper?

There is only one intelligent attitude for the employer to take. He can not deny his employees the right to organize. He can not prevent them organizing. The law compels him to bargain collectively. His only choice today—like it or not—is as to the manner and spirit with which he will deal with his men. Shall their relationship be belligerant or cooperative? Shall he give in step by step, when the pressure forces him to, or do some organizing in advance—with his men?

Whether a contractor now operates open or closed, there is a matter of policy in all this that should not be neglected, in view of present trends. There are three partners in his business—management, capital and labor. Management and labor are the human factors. Labor is numerically the largest influence. He better look this in the face and see that his men begin to understand his business. For there is only one protection against unintelligent interference. Employees must understand the employer's policies, problems and

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profits and realize what they are dependent upon for the earnings that provide their pay.

The present labor situation is deeply disturbing to the employer. It must be even more distracting to the worker, who sees what looks like a new world of privilege and power boiling up around him. Better talk it all over with your men. Get their point of view. Don't argue. Keep your temper. Then give them the simple facts about your business—costs, losses, profits and prospects. It is your strongest defense against labor troubles, your greatest opportunity in this period.

They're Smart In Chicago

Two things of interest have happened recently in Chicago. For years the electric range was barred out of the Windy City, because gas influence was predominant in the local power companies. Now the gas and electric utilities are divorced and competing and the Commonwealth Edison Company is actively promoting ranges, in cooperation with distributors, contractors and dealers. There is a two cent cooking rate, a $35 wiring allowance, a $5 trade-in payment.

But something else has happened too. Chicago is highly unionized and practically nothing but rigid conduit has been installed for years. To get the range campaign going, however, the contractors, the union and the city inspection department have agreed to install a limited number of range wiring jobs in non-metallic sheath cable, under certain conditions, for remodelling or additional outlets. And this is as it should be. For no one will suffer, because it will create a large additional volume of wiring that nobody would have had otherwise.

Why don't contractors, utilities, inspectors and unions in every town work together this way? What everybody wants is more business and plenty more business is waiting. And other towns will do it, as some local man steps out and starts it. The contractor is the right starter.

Some Are Ready Some Are Not

Summer's coming. Some contractors will cash in on it. But some will not. And those who do not, better not blame the season or the city or the Duke of Windsor or the price of peanuts in Peoria. It will be their own fault—mostly.

It is largely a matter of mental attitude and of approach. Those who think of summer only as a season, will just go on using it for perspiring purposes. But those who view it as a high powered, short term market, will plan ahead for it, organize to handle it, concentrate upon it when it comes, and bear away from it those broad fat strips of so called bacon that are so highly prized.

And the best part of it all is that this summer market is broad minded as well as bountiful. It plays no favorites. Anybody can get in. The big contractor, who thinks only of massive buildings and large factories, can do summer selling to his favorite customers. The smaller operator has the same opportunity among the stores and offices and shops or homes he works for. Attic ventilators, office blowers, air conditioning, industrial, commercial and institutional, lighting for sports and festivals. Every man can take his pick, on any scale he wants.

But any man who wants this particular summer, now approaching, to be good to him, better do something about it this month. Otherwise, it will be just hot weather to him and current business and maybe a vacation at the lake—and nothing else.

This Overhead– And What Is It?

Every local association has at some time or another conducted open meetings or "schools" for discussing job costs in general and overhead in particular. In most instances this commendable activity has been short-lived. The audience was quick to become bored and walked out on a well-meaning committee.

The parade of new taxation measures that has come forward in the past few years has increased the overhead of the contracting industry—yet a surprisingly small number of those in business are aware of this fact. Here lies a real job for local and state groups. It is time for discussion of how to properly figure and allow for such items as old age pensions, unemployment insurance, employee compensation and public liability, sales taxes (local and state), contractor licenses, and the rest of it.

This matter of overhead has come to be as deep as a well and as broad as a church door. And it is inescapable, every day in the week.

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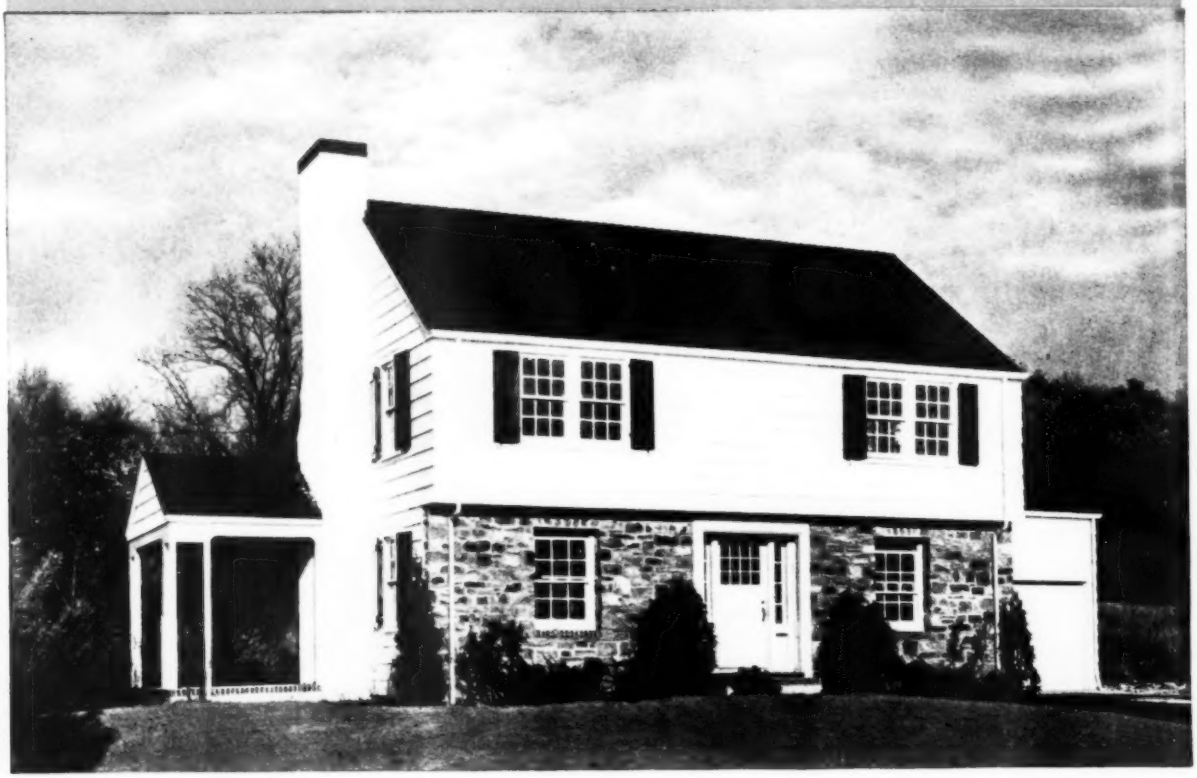
FOR SATISFIED CUSTOMERS AND MORE PROFIT



INSTALL G-E HOME WIRING

Richard M. Ludlow, President of New Castle Homes, Inc., Chappaqua, N. Y., specified the G-E Radial Wiring System, planned wiring, for this home. As a result, the wiring is adequate and the owner enjoys these advantages:

1. No flickering or dimming of lights as encountered with improper wiring.
2. Appliances operate more efficiently and economically.
3. Voltage losses are reduced to a minimum by the design of the system and the use of proper-sized wire.
4. Ample outlets and switches are provided.
5. Service can be safely and easily restored at the circuit breakers which are located at convenient points throughout the house.
6. Circuit breakers may be operated as switches for full circuit control.

Sell the benefits and advantages of adequate wiring not just "adequate wiring." Nine home builders out of ten aren't interested much in switches, wire sizes or outlets but they are interested in the modern comfort and convenience which electricity can bring. They want to be able to use modern electrical appliances. Sell customers this comfort and convenience and automatically you have sold adequate wiring.

G-E Radial Wiring — Planned Wiring.

GENERAL ELECTRIC

APPLIANCE AND MERCHANDISE DEPARTMENT.

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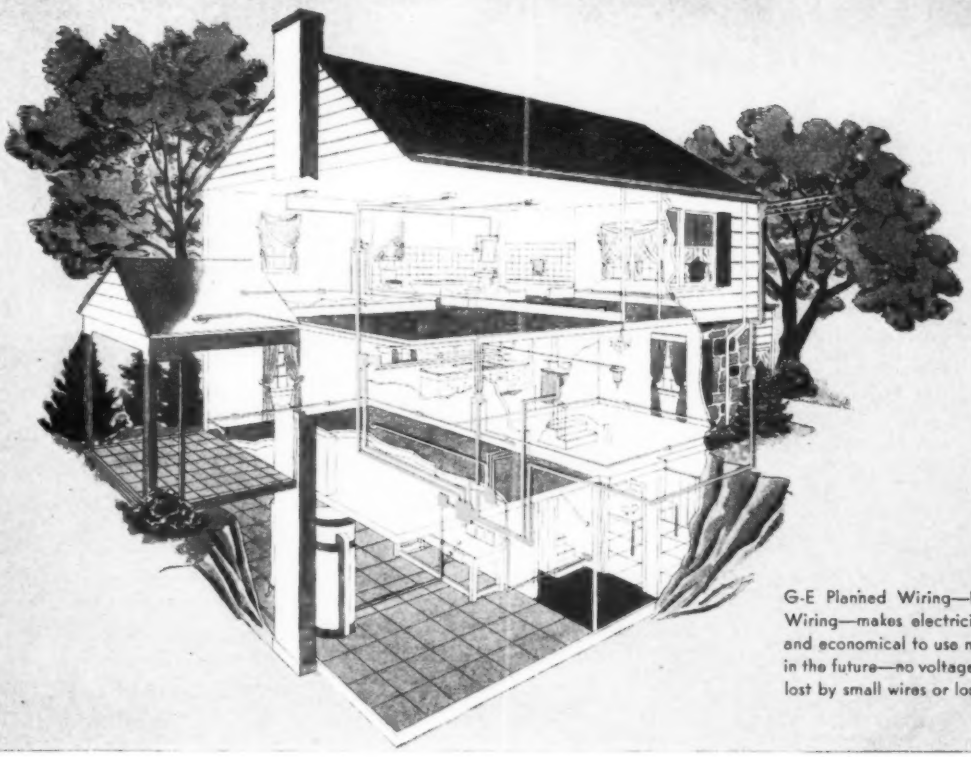
FOLLOW THE WIRING EXAMPLE OF THIS HOME



G-E Planned Wiring—Radial Wiring—makes electricity easy and economical to use now and in the future—no voltage will be lost by small wires or long runs.

G-E HOME WIRING* ASSURES BETTER LIVING

In the cutaway view of the Chappaqua home shown above, there is ample evidence of why G-E Planned Wiring is adequate wiring, and why it assures comfortable and convenient living now and in the future. Wire sizes are large enough and there are plenty of circuits, switches and convenience outlets.

Notice the broad electrical highways, which don't give current a chance to loiter, running directly to small circuit breakers on the first and second floors. Here circuits are controlled conveniently—no fuses to be replaced in the basement. Current has only a short distance to go after it leaves these circuit breakers and the radiating wires over which it travels to outlets aren't crowded. Electric lamps and appliances receive the full amount of current for which they were designed.

Consider this wiring system from your own point of view. Think of the additional profit it assures you over that of a skimpy system. Any extra effort required to sell G-E Planned Wiring is more than repaid in customer satisfaction and extra profit for you.

For full information on G-E Planned Wiring — the Radial Wiring System — see your nearest G-E Merchandise Distributor or write to Section CDW-885, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

*G-E Radial Wiring — Planned Wiring.

Wiring **MATERIALS**

GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONN.

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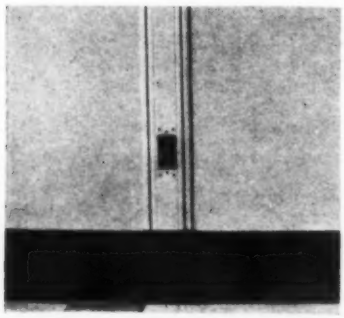
Methods of other CONTRACTORS

PARTITIONS ENCLOSE CIRCUIT WIRING

In wiring a new service, engineering and warehouse building at Youngstown for the Ohio Edison Company, the hollow steel door frames and metal baseboards provided raceways for switches and convenience outlets. The Carlson Electric Company terminated branch circuit home runs and jumper conduits to supply all sections of the baseboard around the walls of each office area. Switch connections from ceiling outlets were stubbed into the top portion of the partitions at all doorways.

The baseboards comprise a solid back member and a removable front section to provide access for installing conductors. Knockouts are not provided for installing future outlets, it being necessary to cut out the metal when other devices are added later on.

WIRED FRAME — Wires in hollow steel door frame connect to flush wall switch from ceiling conduit stubbed in at top of partition.



BASEBOARD RACEWAYS — Future convenience outlets can be added on removable steel cover. Wiring is supplied from homerun conduit stubs and jumper connections at doors.

LADDER HOOKS

Ladders are a needed tool in the contractor's business but they are always hard to store in a crowded shop. The Reserve Electric Co. of Cleveland therefore hangs them overhead on large hooks that were bent from scrap pipe. These hooks are fastened to the ceiling joists. The ladders are thus easily taken down or put away and a lot of space is saved in the shop for keeping other items in their proper place.

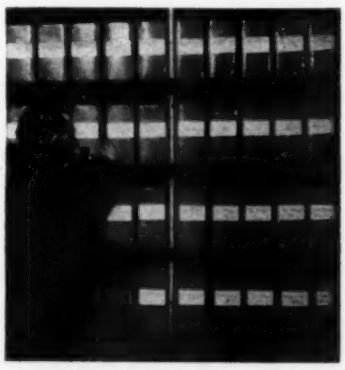
BACK-OF-FITTING SUSPENSION

Close quarters on the primary side of an outdoor transformer station necessitated several 2½-in. conduit fittings being centered directly below 3-in. conduits that were run at right angles. Rigid supports were provided with a minimum amount of excess hanger material by using J-hooks that were made from a ½-in. steel rod to fit over the 3-in. conduit. The lower ends of these hooks were threaded and inserted through holes drilled in the fitting. Each hook was provided with a nut and lead washer inside and outside the fitting, and litharge was packed around the bolt between washers to exclude moisture from the fitting. This method was employed by the Edward J. White Company of Newark, N. J., in modernizing a local paint and varnish factory.

CLOSE QUARTERS — Rigid supports for outdoor transformers made with J-hooks that clamp over horizontal pipe wall braces.

"CANNED" FITTINGS

Small fittings can be kept conveniently in Prestone cans. Robert Y. Chedister of the Midwest Electric Wiring Company of Denver, keeps them this way. He paints the cans gray and labels them plain and finds



STOCK SYSTEM—Chedister keeps small fittings in cans this way.

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VARNISHED CAMBRIC • RUBBER POWER CABLES • BUILDING WIRE • RADIO WIRES • SIGNAL CABLE • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

EASY FISHING!

you bet it is when installations are made with

CRESCENT
SAFECOTE
WIRE *and* CABLE

Wire that's easy to "fish" makes it easy for the men on the job—and easy for you in the reduction of time and labor costs. CRESCENT SAFECOTE Building Wires and Cables have a smooth, firm surface, lubricated sufficiently for easy pulling. They do not stick to the conduit or other conductors and relieve the strain on the insulation and copper. In addition, they are moisture resisting, flame retarding and finished in bright, permanent colors for easy polarity identification.

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Jobber Co-Operation — A Permanent Policy

CRESCENT ENDURITE SUPER-AGEING INSULATION • WEATHER PROOF WIRE

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QUAD
LIGHTING UNITS

NEW MODERN DESIGN
GETTING MORE AND MORE
CONTRACTOR APPROVAL • • •

DUPLEX DOME

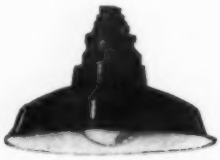
Illuminates the upper walls and ceiling with diffused light and delivers direct light downward. Louvers formed in the metal walls of the reflectors divert sufficient light upward to relieve unpleasant contrast between the bright reflector and dark background. The white porcelain enameled exterior of the reflector and supporting stem are also illuminated. Made in the standard ½" socket type and with heavy threaded hoods (¾" if specified).

Post Top Reflectors

Designed for the general illumination of outdoor locations where a practical fixture of good appearance is important. The unit consists of a green porcelain enameled reflector white inside, with ornamental knob, attached to an urn shaped cast aluminum socket housing by means of heavy cadmium plated iron rods. Three sizes of reflectors accommodate lamps from 200 watts to 1500 watt capacity.

Dome Reflector for Mercury Vapor

Porcelain enameled green outside white inside. Designed for the 400 watt high intensity mercury vapor lamp. Recommended for general industrial illumination. Its wide distribution characteristics combined with the shielding effect of the deep skirted reflector and opal glass diffusing ring make this a most practical unit for comparatively low mounting.



Vapor Proof Fixtures and Reflectors

Of standard construction comprising a green enameled cast iron threaded body, a clear glass globe with threaded neck and a green porcelain enameled reflector. Three body styles include ½" vertical, ½" horizontal, (¾" if specified) and outlet box type in both medium and mogul sizes. Four types of reflectors are offered.

Deep Bowl for Mercury Vapor

The Quad Deep Bowl Reflector for the 400 watt high intensity mercury vapor lamp is recommended for general illumination in industrial plants where conditions require higher-than-ordinary mounting. Reflector is porcelain enameled white inside, green outside and equipped with a 3¼" threaded copper ring to engage the porcelain enameled steel socket-hood.

INVESTIGATE NOW!

QUADRANGLE MFG. CO.
32 S. PEORIA ST.
CHICAGO, ILL.
MEMBER OF RLM STANDARDS INSTITUTE

QUAD

Methods of other CONTRACTORS

[FROM PAGE 36]

they have several advantages.

The uniform containers make the stock easy to find. The bottoms do not fall out when the containers are lifted as with cardboard cartons. The cans are easily put back in place. They are more efficient than drawers because they don't "stick." Taking inventory is made easy too, says Bob Chedister. He inserts a hand in each can and gets the answer without struggling with carton tops or pulling out drawers.

SPOTLIGHT BRACKET AT FACTORY WINDOW

Adjustable 300-watt spotlights or intensifiers were needed at various locations in modernizing a Chattanooga,

ADJUSTABLE SPOTLIGHT—Local lighting near large windows mounted on rigid brackets.

Tenn., pipe foundry. Some of these lights are in areas, where attachment to the movable steel window framework was not feasible.

Mounting brackets were made of two horizontal pieces of angle iron, bolted to the nearest column. The brackets were made long enough to reach the center line of a window. In wiring them the Terrell Electric Company installed the spotlight bases on these rigid extension brackets at the desired location. Then a plug outlet was placed at the mid-point of each extension arm, with a wall switch on the column.

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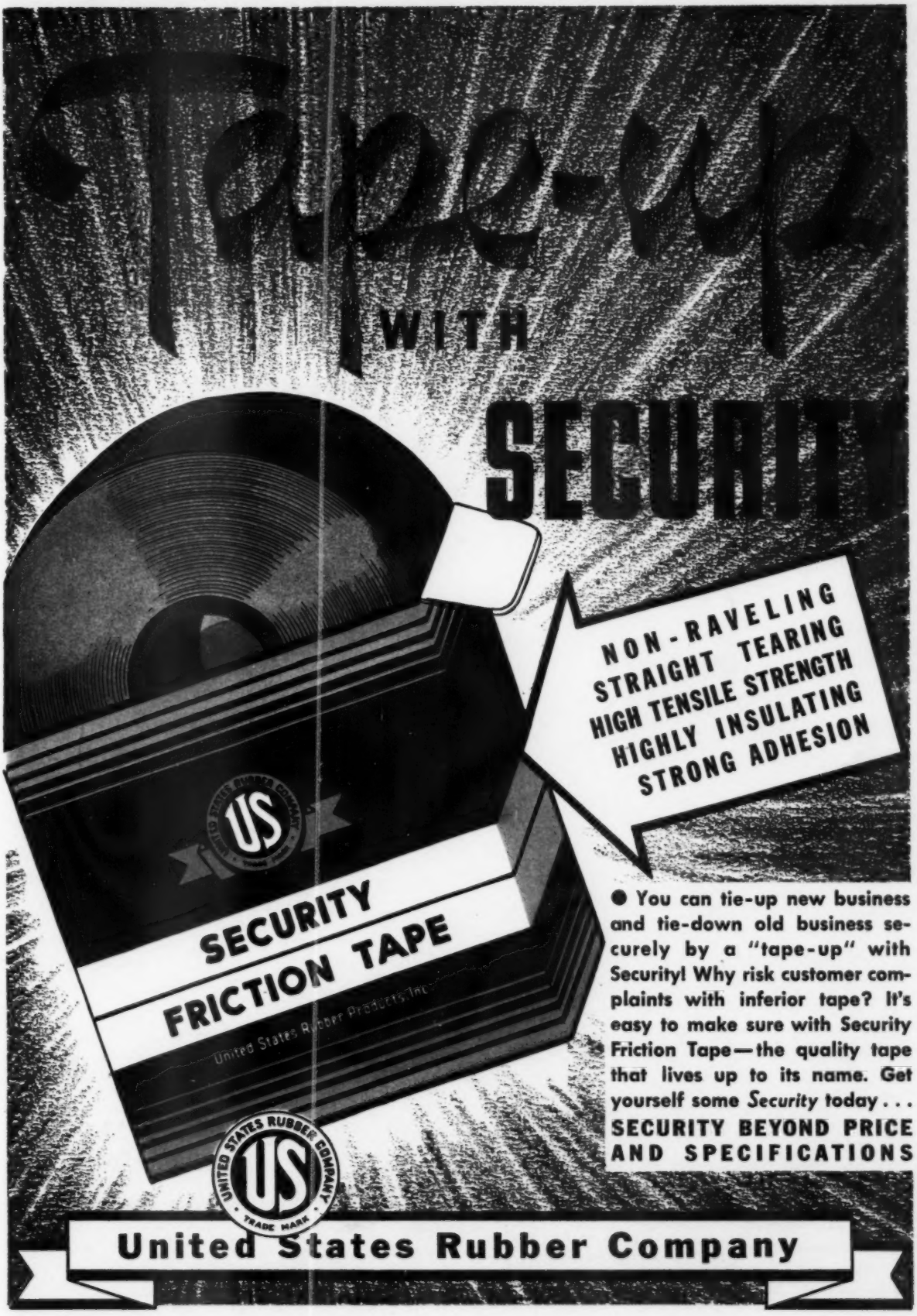
Tape-up
WITH
SECURITY
NON-RAVELING
STRAIGHT TEARING
HIGH TENSILE STRENGTH
HIGHLY INSULATING
STRONG ADHESION
US
SECURITY
FRICTION TAPE
United States Rubber Products, Inc.
UNITED STATES RUBBER COMPANY
US
TRADE MARK
● You can tie-up new business and tie-down old business securely by a "tape-up" with Security! Why risk customer complaints with inferior tape? It's easy to make sure with Security Friction Tape—the quality tape that lives up to its name. Get yourself some *Security* today . . .
SECURITY BEYOND PRICE AND SPECIFICATIONS
United States Rubber Company

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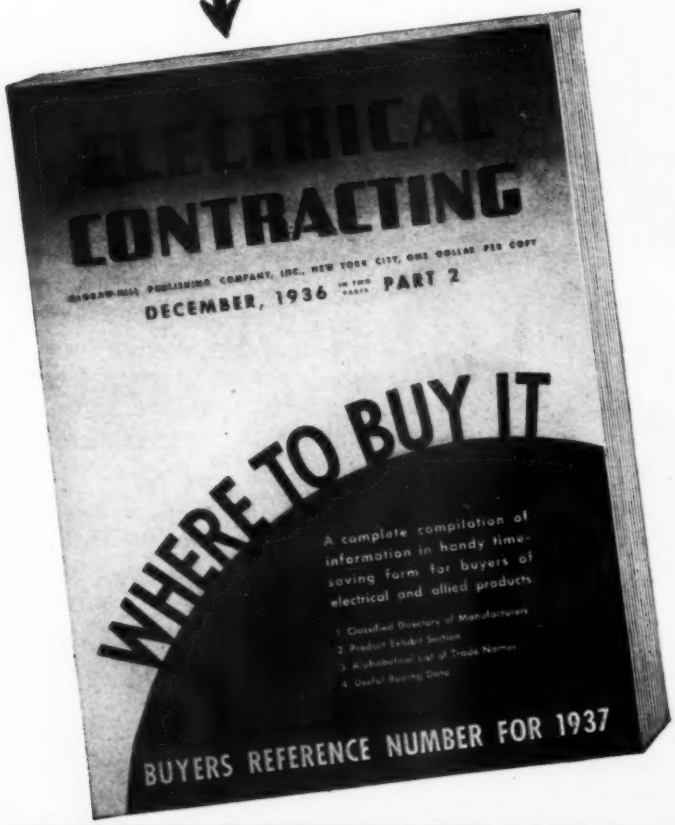
Look here . . . . to find out

WHAT TO BUY

WHERE TO BUY IT

WHO MAKES IT


ELECTRICAL
CONTRACTING
DECEMBER, 1936 PART 2
WHERE TO BUY IT
A complete compilation of information in handy time-saving form for buyers of electrical and allied products
BUYERS REFERENCE NUMBER FOR 1937

The Electrical Buyers Guide for 1937!

●

Revised and Published Annually by

ELECTRICAL CONTRACTING

330 W. 42nd St., New York, N. Y.

"WE NEED YOUR HELP... and there's Plenty in it for YOU...TOO!"

WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.

HERE'S THE STORY:

Westinghouse needs your help and cooperation -- and in giving it to us, you'll make money for yourself. Here's the whole story:

Several years ago we introduced Nofuze "De-ion" circuit protection. Since then we've done a pretty fair job. More than 2,000,000 circuits are now Nofuze-protected.

BUT, we've got to admit that a good big percentage of sales have been to large companies with Safety Departments and cost-analyzing engineers in charge. These men took the time to investigate the GREATER SAFETY and SAVINGS Nofuze protection makes possible -- and they bought!

Yet, you know as well as we do that the majority of plants don't have big electrical and safety departments. They depend on YOU for expert advice on electrical equipment. Now, we don't think for a minute that you can spend a lot of time running around trying to sell a low-priced circuit-breaker alone -- but that's just the point of this letter ...

We have quite a number of Contractor friends who have actually proved that the Nofuze breaker is the best "door opener" they ever had to --

SELL NEW WIRING JOBS and to SELL MAINTENANCE CONTRACTS.

We're writing this letter because we think more contractors will take advantage of the Nofuze idea as a selling idea if they have the FACTS. Our wholesalers have full details and proof on how breakers save money for the plant that installs them. We invite you to call the nearest one now.

Sincerely yours,

Westinghouse Electric & Mfg. Co.

Every House needs a Westinghouse

NOFUZE "DE-ION" CIRCUIT BREAKERS 100% Safety PLUS Important Savings

CS (AC) MOTORS for any constant-speed drive—all sizes and types.

(AC) MOTORS. ...ry's most popu... ...neral purpose ...tor.

"DE-ION" LINE-STARTERS—Most important forward step in entire history of motor control equipment.

SAFETY SWITCHES—Every ...e and type, with exclusive Westinghouse Diamond-pointed ...er construction.

FROM INCOMING LINE TO DRIVEN MACHINE
Install
Westinghouse

UMI

All
STEELDUCT
CONDUIT
is~
THREAD-PROTECTED

• Threads on Steelduct Rigid Conduit are assured complete protection from injury both in handling and shipping. This thread protector also keeps them free from an excess of enamel so the conduit reaches the job ready to install without having a die run over the threads.

A COMPLETE LINE OF RIGID STEEL CONDUIT
ELECTRO-GALVANIZED
HOT-DIP GALVANIZED
BLACK ENAMELED
AND
Electrical Metallic Tubing

The STEELDUCT Company
YOUNGSTOWN··OHIO

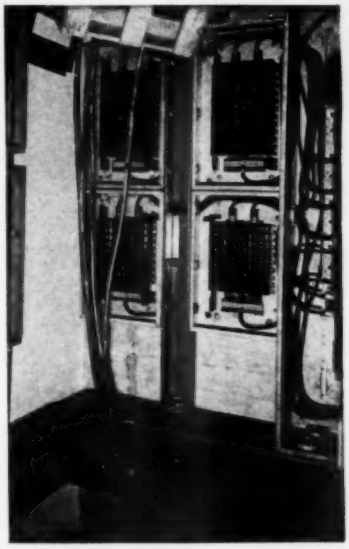
Methods of other CONTRACTORS

[FROM PAGE 38]

The spots can thus be moved back and forth as required, because a flexible cord provides a means of connection. The spotlight frame is always grounded, since it clamps to the steel bracket.

IN-BETWEEN WIREWAY

With only a limited space available for installing six panelboards to control 130 store lighting circuits, a vertical in-between wireway was installed by Morris Hunter of Richmond, Va., that eliminated over-

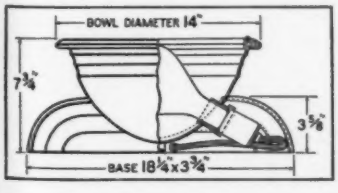


GUTTER RELIEF—Crowded connections handled through special vertical in-between wire way provided for this purpose beside panels.

crowded gutter spaces. The upper panelboard was thus relieved of having the circuits from the lower unit pass through its gutter, and the 6-in. by 4½-in. vertical wireway took the place of conduit nipples that would have been needed for connecting to the overhead junction box. From the feeder distribution panelboard that was installed at the left, close nipples were provided for the various panelboard feeder conductors to be routed most directly to each set of main terminals.

CURTIS
Portable Luminaires

Here is the "Homer" Luminaire, a number you can really afford to push. . . . With these Portables you walk into a lighting job, make your installation quickly and easily . . . and walk out with a profit. Curtis Portable Luminaires give your prospects modernized indirect lighting at low cost. These units plug in existing outlets for portable arrangements, or mount permanently on shelves or cabinets. Read these specifications . . . see the example to the right . . . then send the coupon below for full details.



LAMP: One 500-watt or one 300-watt inside frosted lamp.

MATERIAL: Base, Heavy gauge steel. Bowl, Lunax (Alzak) Aluminum.

FINISH: Exterior of bowl, Lustrous Aluminum with polished highlights. Diffuse Lunax reflecting surface. Base brightly Polished Nickel.

CATALOG DATA: Code name: "Homer." Catalog No. 41. This unit may be secured with color rings at slight extra cost. One mogul porcelain socket is concealed in base and burns lamp nearly horizontal. Wire and plug not included. Shield furnished to minimize the light splash when units are located close to the wall. Units are packed one to a carton. Immediate delivery.

CURTIS LIGHTING

New York CHICAGO Toronto

REPRESENTATIVES IN ALL PRINCIPAL CITIES

CURTIS LIGHTING, INC.
1123 W. Jackson Blvd.
Chicago, Illinois

Please send me the full story of your Portable "Homer."

NAME_____

ADDRESS_____

CITY_____ STATE

UMI

Among the MOTOR SHOPS

SELF-RECEDING PRESS

For pressing bushings in or out of motor end frames, and other jobs around the shop, the Electrical Maintenance and Repairs Company, Ltd., of Toronto, made up a 1-ton hydraulic jack that is easy to operate. It has

SPRING ACTION—Small press which uses 1-ton hydraulic jack, has coil springs to shove jack back up to the "off" position.

springs to push the jack back to the "off" position, as soon as the hydraulic pressure is released.

The jack ram or push rod is welded to a fixed overhead cross member. The base of the jack is welded to a ¼-in. by 4-in. flat iron base that slides up and down along a pair of vertical ¾-in. guide and strain bolts. Steel mandrels are used in sizes to suit the job. When the hydraulic jack pressure is released, a set of compound coil springs push the jack upward to a fully released position.

This outfit stands 36-in. high, and consists of two 8-in. by 4-in. by 22-in. I-beam base rails that are held parallel by two ½-in by 3-in. by 14-in. flat iron welded cross plates. The strain bolts extend between these cross plates and a 2-in. by 2-in. by 21-in. iron cross bar, upon which a pair of 60 amp. fuse clips are mounted to receive the jack handle.

The compound coil springs were made up by telescoping one set of long springs over 1-in. conduit nipples 10-in. long. A locknut at the bottom end of each nipple serves as a stop-collar for the outer telescoping spring. Within each nipple is another spring that butts against a welded-on plug at the upper end. The plugs in these nipples are drilled for sliding up and down on the ¾-in. strain bolts. The jack bed plate has ¾ in. nipples 5-in. long welded to it to serve as guide sleeves for the ¾ in. rods.

BENCH TESTS WITHOUT HAYWIRE

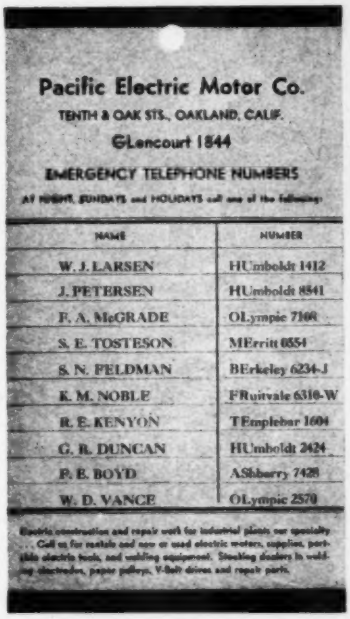
These new benches in the H. N. Crowder, Jr. Company shop in Allentown, Pa., are equipped with compact testing panels at 6-ft. centers. This does away with any maze of wires in the way of motor repairmen.

Each panel consists of a dead front metal cabinet upon which are mounted plug outlets for a 110-V series test lamp; a 110-V, single-ph. multiple circuit; a 220-V, single-ph. multiple circuit; and a 220-V, 3-ph. circuit. Each outlet has its own set of fuses inside the cabinet. The test lamps are mounted on vertical conduit stems directly in front of each repairman. Each test lamp socket has a hook on it for attaching the workman's clip-board that holds his work orders.

HANDY CIRCUITS—A dead front test panel, every six feet, with plugs for four purposes.

AFTER-HOURS TELEPHONE DIRECTORY

Customers of the Pacific Electric Motor Company, Oakland, Calif., are provided with the emergency telephone numbers of ten members of that organization who may be called at night, Sundays and holidays. This information appears on a 3½-in. by 6½-in. card that



Pacific Electric Motor Co.

TENTH & OAK STS., OAKLAND, CALIF.

GLencourt 1844

EMERGENCY TELEPHONE NUMBERS

AT NIGHT, SUNDAYS and HOLIDAYS call one of the following:

NAME	NUMBER
W. J. LARSEN	HUmboldt 1412
J. PETERSEN	HUmboldt 8541
F. A. McGRADE	OLympic 7166
S. E. TOSTESON	MErritt 0554
S. N. FELDMAN	BErkeley 6234-J
K. M. NOBLE	FRuitvale 6316-W
R. E. KENYON	TEmplebar 1604
G. R. DUNCAN	HUmboldt 2424
P. B. BOYD	AShberry 7429
W. D. VANCE	OLympic 2570

Electric construction and repair work for industrial plants our specialty . . . Call us for rentals and new or used electric motors, supplies, portable electric tools, and welding equipment. Stocking dealers in welding electrodes, paper pulleys, V-belt drives and repair parts.

is punched at the top to be hung on a nail. Printed in two colors on a yellow background, this directory of emergency telephone numbers has an attractive appearance as advertising material for this company's services.

KEY NUMBERS FOR SHOP WORK

Shopmen are spared having to write lengthy descriptions of their work, but use a key number or code instead, at the Reserve Electric Company's shop in Cleveland. Key numbers were assigned to operations as follows:

1—Inspect
2—Dis-assemble and clean
3—Bearing work
4—Repair fields
5—Put new leads on old winding
6—Resolder rotor
7—Paint old winding
8—Make brushes
9—Starter winding
10—Running winding
11—Strip stator or armature
12—Make coils
13—Insulate core
14—Put coils on job
15—Connect coils or armature
16—Commutator work, solder up
17—Wedge or band

Vacu-Break

SAFETY SWITCHES

are distinctly *modern* in the truest sense of the term. The circuit rupturing principle from which the Line derives its name, provides a greater degree of Safety against arcing and makes possible smaller and more compact cabinets with adequate wiring space. Stylined Cabinets lend a distinctive outward appearance which reflects the finer inward quality. *Vacu-Break* Safety Switches *perform BETTER—look BETTER* and are *BETTER* in every way.

SWITCH-CENTER PANELBOARDS

The *Switch-Center* Line has gained recognition in the Panelboard field as a most economical product of outstanding quality. Designed from a practical wiring standpoint, it finds favor in factories, garages, warehouses and similar installations and is available in capacities from 4 to 40 circuits with Main Lugs, Main SAFtyFUSE or Main Fusible Switch.

The Line includes the space-saving *NARROW COLUMN* type for installation on columns or pilasters in industrial plants and commercial buildings where space is a big factor.

Above: "PX" Type Plug Fuse only—8 to 40 Circuits. Right: Panel and section of Narrow Column Type Switch Center.

This view shows an Industrial Plant installation of a Bull Dog Dead Front Safety Switchboard from which an enclosed run of BUStribution extends through the entire plant.

SWITCHBOARDS and BUSTRIBUTION SYSTEMS

Bull Dog Dead Front Switchboards are built up of standardized sectional Panels, totally steel enclosed. They combine the flexibility of a standardized unit assembly with the distinctive impressiveness of an integral product.

Bull Dog BUStribution is a flexible Distributing System which readily lends itself to changes or additions to accommodate fluctuating power requirements. It consists of Busbars, enclosed in a metallic Duct, and Branch Circuit Devices which can be "plugged-in" to the Busbars through crescent shaped outlets provided at regularly spaced intervals in the Duct.

BULL DOG ELECTRIC PRODUCTS CO.

DETROIT, MICHIGAN

BULL DOG'S CONSTANT IMPROVEMENTS IN ELECTRICAL DISTRIBUTION EQUIPMENT ASSURE YOU A FINER INSTALLATION WITH REDUCED MAINTENANCE COSTS

Specify
BULL DOG
to Your Electrical Supplier

UMI

EASY STARTING-
AT ANY ANGLE!

MILFORD
FLEXIBLE
The Blade with the
EASY-STARTING TEETH

Electricians prefer this electrical saw. It cuts cleanly, will not break in a frame, and is safe.

There is no wrong way to use this blade. Start a cut on any angle or a corner. The fine, Easy-Starting Teeth take hold at once; will not rip out, and guide the blade for straight, clean cutting.

Ask your jobber for
MILFORD
FLEXIBLE
The Blade with the
EASY-STARTING TEETH

THE HENRY G. THOMPSON
& SON CO.
NEW HAVEN, CONN.
Saw Makers for over Half a Century

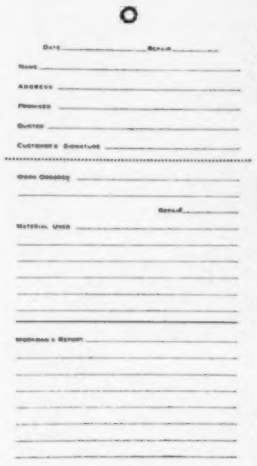
Among the MOTOR SHOPS

[FROM PAGE 44]

18—Dip and bake
19—Turn and undercut armature
20—Assemble
21—Test
22—Paint frame

Because of this condensed system of reporting the work performed, this company uses a shop card only 4½-in. wide and 8½-in. long. The tag is perforated near the middle and the top part remains on the completed apparatus while the bottom end goes into the "completed work" envelope.

When detailed costs are wanted for the labor used on a difficult repair job, a breakdown may easily be secured from the shop. Actual time required for doing each phase of the job may be jotted down together with the proper key number.

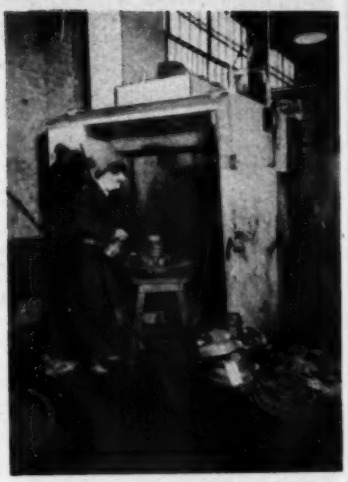


CONDENSED RECORD—Numbers on job ticket designate just what was done.

A LAYOUT FOR TWO-IN-ONE FUME REMOVAL

Workers at the spray booth and cleaning rack are relieved of both enamel and naphtha fumes by placing these production units back-to-back with one common exhaust fan and duct to serve them. This arrangement was made at the Electrical Installation Co. of Cambridge, Mass., when a new sheet steel spray booth was built. One fan does the job of two units, while valuable shop space is also saved by this consolidation.

It was therefore not necessary to cramp the spray-men's style, instead there is room to stand erect and work in freedom. The spray guns and piping are racked inside the booth away from aisle traffic. Vaporproof globes overhead flood the work from two sides.

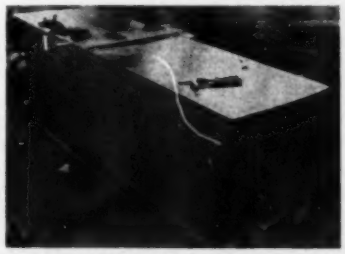


Double Duty—Spray Booth and Cleaning rack served one exhaust fan.

EMERGENCY OVEN

Extra oven capacity for Cincinnati's flooded motors was quickly provided at the Atlas Electric and Machinery Company by assembling stock pieces of sheet steel upon an angle iron frame. Two 10-ft. sheets of 36-in., 12 ga. steel made the sides, and 30-in. pieces formed the ends and a center partition. These were bolted to 1½-in. angle iron sills, corner posts, and a center brace to provide a substantial enclosure.

This structure was set above the concrete shop floor on bricks and equipped with four gas burners. Placed in line with an overhead travelling hoist, its open top made loading easy. Flat steel covers laid on cross-bars and cleared the side walls enough to provide air circulation. A thermometer was nippled through the oven's side wall at the left end.



STOCK ASSEMBLY—*Temporary oven for flood motors, made up from stock sizes of sheet steel and angle iron.*

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THE SUCCESS OF HIS BUSINESS DEPENDS ON THE USE OF GOOD INSULATING MATERIALS

That is why he uses only G-E Insulating Materials. He has an eye on those extra profits and the increased business which G-E materials help him get through building up a reputation for quality and dependability.

If you are not using G-E Insulating Materials, why not try them? They cost no more than ordinary materials but you get that extra large margin of quality. Use G-E Insulating Materials for dependability and extra profits.

There is a G-E Merchandise Distributor nearby who will be pleased to serve you, or write Section M-885, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn., for complete information.

GENERAL ELECTRIC

INSULATING MATERIALS

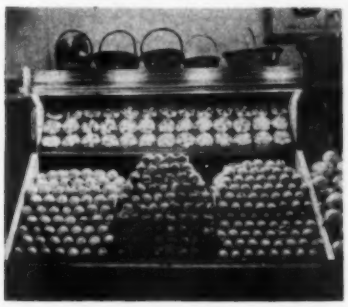
APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC CO., BRIDGEPORT, CONN.

UMI

For Better LIGHTING JOBS

LIGHTING AN OPEN DISPLAY

Bringing merchandise into the open increases the average unit of sale, because the more merchandise the customer sees when he comes into a store, the more he is likely to buy. So it pays to light these open displays.



SMART SELLING—This grocery store lights up its open displays—why not?

This grocery store has installed, above the food displays, continuous reflectors, consisting of metal trough sections containing 60-watt lamps on 9 inch centers. Through removable white frosted glass, illumination is directed down on the merchandise.

OVERVOLTAGE SPORTS LIGHTING

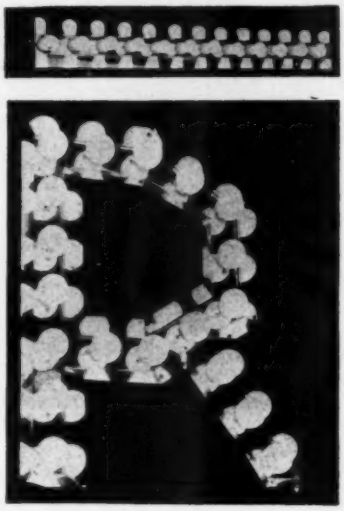
Present popularity of outdoor recreation has created public demand for lighting for sports at night. But in order that large recreational areas may be lighted sufficiently well to satisfy both players and spectators, it is necessary to plan the installation to get the maximum efficiency at a minimum cost.

For lighting baseball, football, and soft ball fields and similar large areas, it is common practice to burn the lamps at 10 per cent overvoltage. By burning the lamps at 10 per cent overvoltage, the light output is increased about 35 per cent at an expenditure of only about 16 per cent in wattage, thus securing a very considerable addition to the light output without additional equipment.

While the life of the lamps is materially reduced by overvoltage burning, they will usually last for several seasons because they are used for short periods during each season. The practice of overvoltage burning is economically sound for all sports lighting, where the area is used only 100 or 200 hours each season and where cost of both equipment and mounting is high.

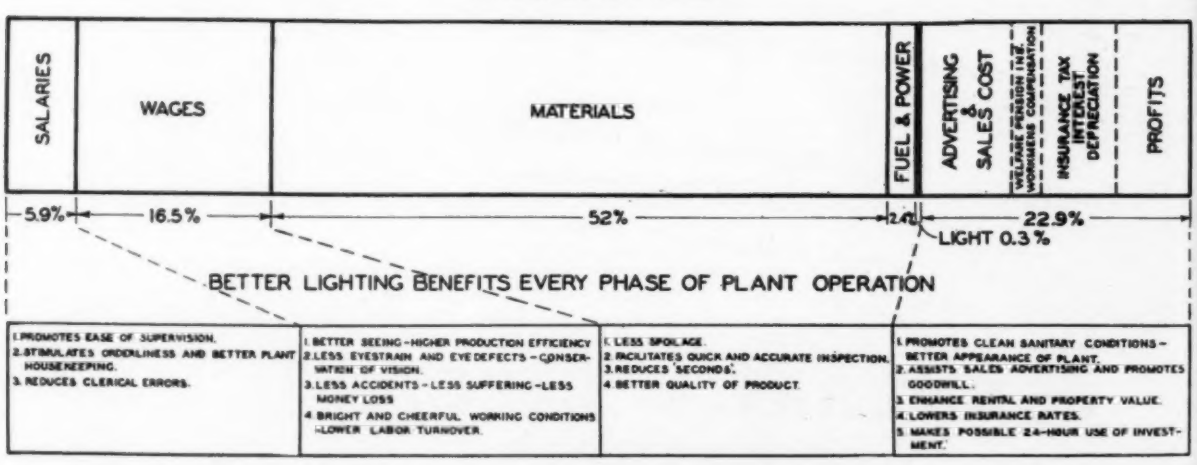
MULTIPLE REFLECTION TROUGH

Here an effect similar to that produced by three rows of lamps is obtained by using only one row. This trough is made up of flat pieces of Alcoa lighting sheet, shaped to follow a parabolic curvature.



THREE FOR ONE—Aluminum sign letters, adaptable for various display effects in signs and windows.

Another effect can be created by using


PRODUCTION COST
SALARIES
WAGES
MATERIALS
FUEL & POWER
ADVERTISING & SALES COST
WELFARE PENSION INS. WORKMENS COMPENSATION
INSURANCE TAX INTEREST DEPRECIATION
PROFITS
5.9%
16.5%
52%
2.4%
22.9%
LIGHT 0.3%
BETTER LIGHTING BENEFITS EVERY PHASE OF PLANT OPERATION
1. PROMOTES EASE OF SUPERVISION.
2. STIMULATES ORDERLINESS AND BETTER PLANT HOUSEKEEPING.
3. REDUCES CLERICAL ERRORS.
1. BETTER SEEING-HIGHER PRODUCTION EFFICIENCY
2. LESS EYESTRAIN AND EYE DEFECTS-CONSERVATION OF VISION.
3. LESS ACCIDENTS-LESS SUFFERING-LESS MONEY LOSS
4. BRIGHT AND CHEERFUL WORKING CONDITIONS-LOWER LABOR TURNOVER.
1. LESS SPOILAGE.
2. FACILITATES QUICK AND ACCURATE INSPECTION.
3. REDUCES 'SECONDS'.
4. BETTER QUALITY OF PRODUCT.
1. PROMOTES CLEAN SANITARY CONDITIONS-BETTER APPEARANCE OF PLANT.
2. ASSISTS SALES ADVERTISING AND PROMOTES GOODWILL.
3. ENHANCE RENTAL AND PROPERTY VALUE.
4. LOWERS INSURANCE RATES.
5. MAKES POSSIBLE 24-HOUR USE OF INVESTMENT.

WHERE LIGHT HELPS—This simple chart presents the economies that good lighting effects in a factory. Use it in discussing modernization plans with your industrial customers.

UMI

A Powerful Ally in Closing Sales

There's no doubt about it—show window modernization is definitely on the up-swing. Merchants everywhere are remodeling long-neglected windows.

Wholesalers and contractors from all over the country report that **Sterling** Lite-Flo Reflectors are helping them get this business, because extra lighting effectiveness per unit of operating cost has tremendous appeal to alert merchants.

The attractive brochure, "Increased Sales Punch with Same Operating Cost" has been developed especially to help you present **Sterling** Lite-Flo Reflectors most effectively.

Write for your copy today. It tells the **Sterling** Story of Greater Lighting Efficiency—in words—in diagrams—and in actual installation pictures showing windows of prominent stores. Just mail the coupon.

Reflector & Illuminating Co.,
1435 W. Hubbard St., Chicago

Send brochure, "Increased Sales Punch with Same Operating Cost."

Name .....

Address .....

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INSURE
LOW-COST
INSULATOR
SERVICE with
ILLINOIS
PIN TYPE DISTRIBUTION
INSULATORS

● The wide acceptance given the Illinois porcelain insulators by the Utilities and Electrical Manufacturers is the result of economical and dependable performance under any condition.

Distribution insulators are made from the same high grade porcelain as is used in the manufacture of the larger high voltage insulators.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

ILLINOIS

For Better LIGHTING JOBS

[FROM PAGE 48]

a diamond pattern. Here the lamp reflections are broken up, while at the same time, the multi-reflection is retained. This effect also can be advantageously applied to the design of letters four feet or larger.

SUPPLEMENTARY LIGHTING GEAR

Severe visual tasks in factories and stores require higher levels of illumination, to eliminate eyestrain or to highlight special displays, than are practical or economical to obtain from a system of general lighting alone. Supplementary lighting should be employed that provides 10 to 20 footcandles. For high levels defeat their own purpose if glare, harsh shadows and severe contrasts are not eliminated.

Proper solution of supplementary lighting is not so much a question of computing the actual footcandles delivered, as the method employed, the equipment used, and its location with respect to the specific seeing task or the particular type of display. When these factors are determined, the lamp requirements may be computed from the distribution curve of the specific equipment or determined experimentally.

The footcandles recommended for supplementary lighting can be roughly grouped into these three general classifications, according to the difficulty of the visual tasks involved.

100 Footcandles or More—Necessary where visual tasks involve (1) extremely fine detail, (2) materials of exceptionally low or poor contrast, and (3) prolonged duration.

50-100 Footcandles — Necessary where visual tasks involve (1) fine detail, (2) medium contrast in materials, (3) less prolonged duration.

30-50 Footcandles—Necessary where visual tasks involve (1) moderately fine detail, (2) materials of average contrast, and (3) critical seeing only intermittently.

LIGHTING THE BLACKBOARD

Chalk on slate continues standard for most blackboards and when the class is large and the teachers demonstration requires sharp concentration,

ANOTHER IDEA—Now while school boards are studying their lighting for summer alterations, suggest this one.

blackboard lighting makes a vast improvement. Use units delivering light through prismatic glass plates, from two 150-watt lamps. These units should be mounted on five foot centers and provide 25 footcandles of illumination on the blackboard.

FOR EYE EASE—Typical supplementary or specialized lighting equipment useful to relieve high level illumination under various conditions.

UMI

Application
Installation
and MAINTENANCE
In Industrial, Commercial and Institutional Buildings

Let's Check Up On DRIVES

A chain is no stronger than its weakest link. That proverb can profitably be reworded to refer to drives in an industrial plant.

A NEW STUNT FOR GROUP DRIVE

When the new knitting plant of the Tubize Chatillon Corporation was built at Hopewell, Va., lineshafts and driving motors for group drive were installed in trenches cast in the concrete floor. In this way, certain disadvantages of overhead belting were eliminated while the advantages of group drive were retained.

Maintenance costs have been reduced considerably. To get at one of the hangers it is merely necessary to lift up the belt guard and trench cover.

Production equipment can be no better than the motors and transmission equipment powering it. Proper application and maintenance of industrial drives is therefore an important year-round responsibility.

In applying a spare motor, or shifting a motor from one machine to another, the operation of the driven machine is quite often overlooked. But using the right kind of motor for the job is extremely important, if trouble-free operation is to be expected.

Motors

For polyphase circuits, squirrel cage and wound-rotor motors are commonly used; for single phase circuits the repulsion-induction type; for d.c. circuits, shunt-wound and compound-wound machines. But of these several types, the squirrel cage motor is found in greatest number.

Squirrel-cage motors are built with various types of rotors to meet starting and running conditions. In general, the stator design is the same. The motors are therefore classified as—

1. Normal torque, normal starting current — *lathes.*
2. Normal torque, low starting current — *centrifugal pumps.*
3. High torque, low starting current — *reciprocating pumps starting against back pressure.*
4. High torque, high slip — *punch presses.*

A reference to local regulations regarding starting current will assist in

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INDIVIDUAL DRIVE ON A POLISHING JOB

Ten belt polishing lathes have been motorized at the silver manufacturing plant of Reed & Barton, Taunton, Mass., because a trial installation was so satisfactory to the management. In the pictures, the old method of driving is shown below and the latest practice above.

In this department both sterling and plated forks are polished between the tines, and spoons receive their fine facing. The earlier method used group drive. Each machine had a 2-in. abrasive belt running between pulleys, with a step-by-step adjustment for tightening. Bearings were not sealed and frequently became overheated and badly worn from accumulation of emery dust. Maintenance costs were high. Overhead shafting also interferred with natural light needed for this close work.

Individual drive is now applied with a 1-hp. induction motor running at 1,800 r.p.m., 550 volts, three-phase design. Sealed ball bearings are provided, with a screw adjustment of belt tension. The set-up is compact, and electricity need be consumed only while work is being done. Clearances are improved, lighting conditions bettered.

determining the type of motor to be used. In some places, squirrel-cage motors as large as 30 hp., corresponding to classifications 2 and 3 above, may be started on full voltage; in other locations, an auto-transformer or resistance type starter is required for motors 7½ hp. and larger, or a wound-rotor motor with starting resistor and controller.

Where d.c. power is used, shunt-wound motors may, in general, be employed for applications corresponding to classifications 1 and 2 above, and compound-wound motors for those corresponding to classifications 3 and 4 above. On all d.c. motors, particularly ½ hp. and over, a resistance-type starter should be used to prevent pitting of the commutator, and possible flash-over.

Overloading

A temperature rise above normal means that the motor is drawing an excess of current, and most often the trouble is overloading. Sometimes the overheating is caused by low voltage.

Overloads are not only harmful to the motor itself. They also lower power factor and efficiency, and so increase the power bill.

If inspection shows that a motor is overheating, the maintenance man first checks mechanical details, such as alignment, belt tension, ventilation, air gap, and lubrication. If these and the voltage are satisfactory the overheating is probably caused by overload.

Checking Load

Elaborate wattmeter checks are usually not necessary. The maintenance man can estimate loading by means of an ammeter reading, using the values of amperes per hp., based on the full-load rating of the motor, given in the accompanying table.

AMPERES PER HORSEPOWER (APPROXIMATE

Direct Current

(Motors 1 to 15 hp.)

Volts	*Amp. per hp.*
115	8
230	4

Alternating Current

(Single-phase-motors 1 to 10 hp.)

Volts	*Amp. per hp.*
110	10
220	5

(Three-phase-motors 1 to 75 hp.)

Volts	*Amp. per hp.*
110	5.0
220	2.5
440	1.25
550	1.0

Of course, this method gives only a rough estimate of loading, because efficiency, and, in the case of a.c. motors, power factor as well, varies with load. However, it will suffice in most cases.

Underloading

General purpose motors have aproximately the same efficiency when operating between 75 and 100 per cent load. However, the power factor of a.c. motors will be several per cent less at 75 per cent load, and if the motor is greatly underloaded (or if it runs idle, as when an operator forgets to open the line switch when finished with the machine) power factor drops considerably. Since a.c. motors are inefficient if run underloaded, the duty cycle of such drives should be checked, and, if necessary, the motor should be replaced with one of lower horsepower rating.

Inspection

Correctly applied motors, like other machines, need attention if they are to operate efficiently. It is important, therefore, that the maintenance man give them definite, periodic, inspection. Inspection should cover the following:

1. Megger test of insulation.
2. Check for loose terminals, coils, and armature bands.
3. A check for worn sliprings, commutators, and brushes.
4. Renewal of oil or grease in bearings.
5. Air gap check to determine wear of bearings.
6. Check on ventilation — free movement of air in vicinity of motor.
7. Blowout of stator and rotor.
8. Removal of oil and grease from windings.

This inspection should, of course, also include the motor control. Space does not permit going into the details of the various types of control. Types in common use are—across-line starters, auto transformers, and resistance-type starters and regulators. However, the important control items to check are:

1. Replacement of worn and pitted contacts.
2. Adjustment of contacts, springs, and interlocks.
3. Tightening of terminals and set screws.
4. Check-up of operation of relays.
5. Blowout of resistors.
6. Renewal of oil in auto transformers.
7. Replacement of covers on starters.

Mechanical Power Transmission

Any check-up of drives must, of course, include examination of the me-

(Continued on page 54)

UMI

ELECTRICAL MAINTENANCE GUIDE SHEET

APPLICATION CHART FOR MOTOR DRIVES

APPLICATION		OPERATING CONDITIONS		TYPE OF MOTOR	
				A. C.	D. C.
BLOWERS and FANS COMPRESSORS (start unloaded) CONVEYORS, PORTABLE and LIGHT PACKAGE LINE SHAFTS METAL WORKING, CUTTING, GRINDING, POLISHING PUMPS (start unloaded) SEWING WOODWORKING PACKAGING and WRAPPING		Normal Starting Constant Speed		Squirrel Cage— normal torque, normal starting current Single Phase, Repulsion-Induction Capacitor	Shunt wound
SAME AS ABOVE		Normal Starting Full Voltage Start Constant Speed		Squirrel Cage— normal torque, low starting current Single Phase, Repulsion-Induction Capacitor	Shunt wound
COMPRESSORS (start loaded) CONVEYORS, BULK MATERIAL CRANES ELEVATORS HOISTS PUMPS (start loaded)		Heavy Starting Constant Speed		Squirrel Cage— high torque, low starting current Single Phase, Repulsion-Induction Capacitor	Compound wound
PUNCH PRESSES SHEARS MACHINE DEPENDING ON FLY-WHEEL ACTION TO CARRY PEAK LOAD		Very Heavy Starting, Occurring Not More Than Twice a Minute Constant Speed		Squirrel Cage— high torque, high slip	Compound wound
MACHINES REQUIRING TWO OR MORE SPEEDS	Constant Horsepower	Normal Starting Same Horsepower at All Speeds		Squirrel Cage— multi-speed	Shunt wound adjustable speed
	Constant Torque	Normal Starting Reduced Horsepower at Lower Speeds			
FANS, BLOWERS, PUMPS		Light or Normal Starting	Constant or Adjustable Varying Speed	Wound-Rotor	Shunt wound
CRANES, HOISTS		Frequent and Heavy Starting			Compound wound
POWER FACTOR CORRECTION CLOSE SPEED REGULATION		Normal Starting Constant Speed		Synchronous	

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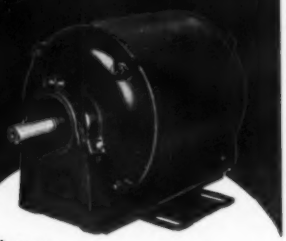
PROFIT *with* Wagner Motors



Small Motors

Electrical dealers and contractors can profit by handling a well-known, dependable and complete line of both fractional- and integral-horsepower motors.

Wagner motors are well-known to both industry and the home. Millions of homes have Wagner-motored refrigerators, oil burners, coal stokers and other appliances giving satisfactory service to their owners. Wagner motors have long been faithfully driving thousands of different applications in industry. The name "Wagner" has therefore developed wide customer acceptance. This means a lot to you—it means that it will require less sales effort on your part to sell and recommend Wagner motors.

In addition, whenever you recommend Wagner motors to your customers, you can give them an absolute assurance that they are guaranteed and will give satisfactory service and trouble-free operation.

Send for catalog and secure full information about Wagner Motors

NM237-1A.

Large Motors

Wagner Electric Corporation

6400 Plymouth Ave., St. Louis, Mo.

MOTORS · FANS · TRANSFORMERS · BRAKES

Let's Check Up On Drives

[FROM PAGE 52]

chanical power transmission. Depending on the type of mechanical equipment used, the maintenance man must see to it that:

1. Motor is securely mounted and lined up properly.
2. Pulley is true, made of suitable material for the duty, and is securely fastened on the shaft.
3. Belt has been properly selected for material, width, and thickness, is under correct tension, clean, shows no evidence of burning or of laps opening. Belt must, of course, be running true.
4. Shafting, couplings, gears, and chains must be in alignment.
5. Sufficient lubrication must be supplied at regular periods.
6. All drives must be equipped with proper safeguards.

The system of drives in a plant may be broadly classified as group or individual. With group drive, a number of machines are driven by one motor through lineshafts and belts. With individual drive, a motor is mounted on or adjacent to the machine to be driven, and power is transmitted by coupling, clutch, belt, gears, chain, or by mounting the rotor of the motor directly on the driving shaft.

Improvements in methods or products usually bring about changes in the power requirements of individual machines. Also, modern machines may have been added to a group or they may have replaced other machines. With group drive, such changes may increase the load on the lineshaft and motor. Of course, increased power for some machines may balance the decrease on others.

In addition to inspection of belts, shafting, bearings, clutches, and the like, a study should be made as to the advisability of dividing a group drive into two or more groups. Or, one or two machines might advantageously be arranged for individual motor drive.

Conditions favorable to group drive are:

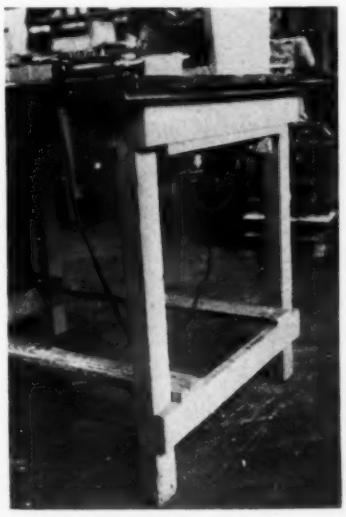
1. Machines must be operated continuously or at the same time.
2. Loading is such that individual drive would require motors below 2 or 3 hp.
3. Large number of constant-speed machines make it possible to put them all on one shaft.
4. Use of machines in combination makes it possible to flatten out load peaks on group drive.
5. Certain machines require high starting torque, which can be obtained by using reserve capacity of motor powering the group drive.

Conditions favorable to individual drive are:

1. Machines are isolated.
2. A number of machines require adjustable speeds.
3. Some machines require automatic, remote, or complicated control.
4. Some machines must be operated at intervals or on overtime.

Plug-ins Made Efficient

Loose plug connections were a source of trouble for the Pilot Radio Corporation of Long Island City. Most of the plug outlets were mounted in inverted positions under assembly and test benches because of vibration and pulling of flexible cords, the attachment plugs for such devices as soldering irons would not maintain firm contact in these up-side-down receptacles. Some plugs even fell out completely. Loose plug contacts caused pitted contacts in the receptacles and also interfered with the normal heating of soldering tools.



***LOCKED IN**—These modern receptacles and plugs make firm electrical contact and remain mechanically locked in place by a twist of the plug.*

The trouble was corrected by replacing the existing receptacles and plugs with a popular mechanical locking type. The plug is inserted and given a rotary twist which engages it in the receptacle. This provides positive electrical contact while also providing mechanical security against vibration and cord strain. The Furst Electric Company, Inc. of Long Island City, N. Y. has changed 250 outlets in this plant to date. Because of the improved working conditions which resulted from this change-over, about 250 more outlets are to be similarly equipped.

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Introducing

HARVEL 612C

INSULATING VARNISH

Sensitive to the urgent need for an insulating varnish that would eliminate the shortcomings of traditional oil type insulating varnishes, the combined research laboratories of the Irvington Varnish & Insulator Company and the Harvel Research Corporation have developed Harvel 612C, superior in physical, electrical and protective characteristics.

ELEVEN OUTSTANDING FEATURES

Produces firm, tough mechanically **strong coating.**

•

Penetrates throughout.

•

Bonds conductors into a **compact** unit acting mass.

•

Is **stable,** insuring **constancy** of electrical properties.

•

Is **non-corrosive.**

•

Is **oil-proof** to a high degree.

•

Has exceptional **acid and alkali resistance.**

•

Has high **dielectric strength.**

•

Has **no objectional solvents** that attack enameled wire.

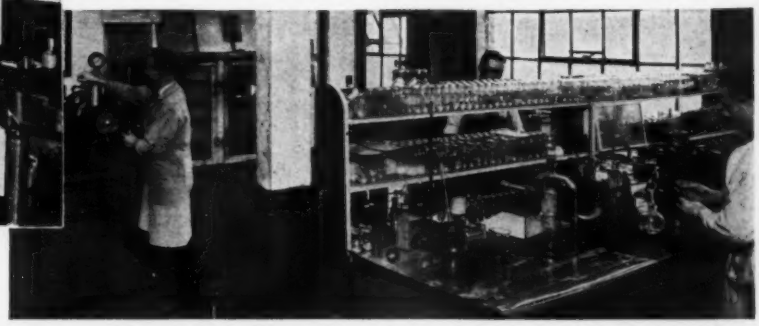
•

Cures to an **infusible** state. Will **not soften or throw.**

•

Will **not liver or solidify** during storage.

Write for technical bulletin number 22A. Which completely outlines the numerous features of HARVEL-612C



STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE MARK

Manufactured under **HARVEL PATENT LICENSES** *by*

IRVINGTON VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U.S.A. *Est.* **1905**

VARNISHED CAMBRIC • VARNISHED CAMBRIC TAPES • IRV-O-SLOT • VARNISHED CANVAS
VARNISHED SILK • FLEXIBLE VARNISHED TUBING • VARNISHES AND COMPOUNDS

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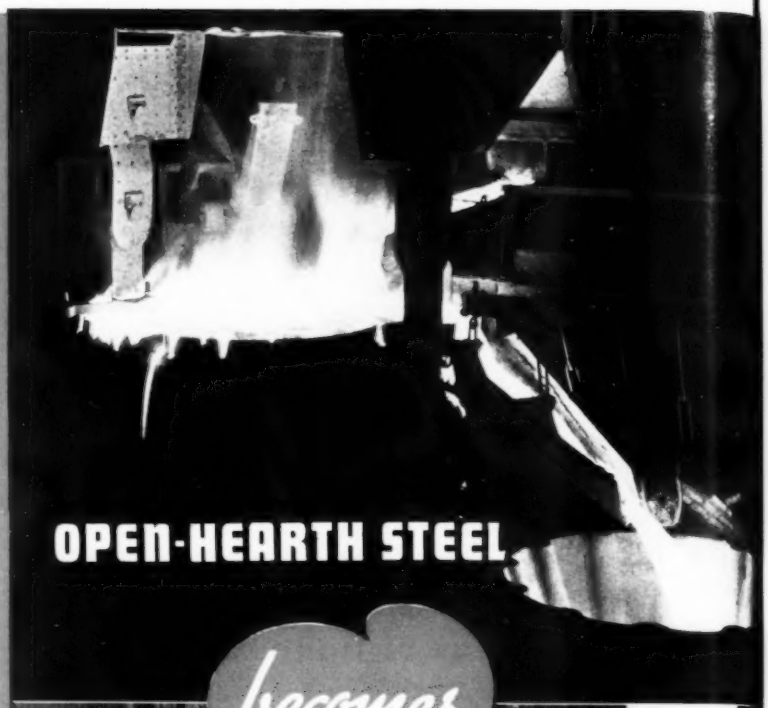
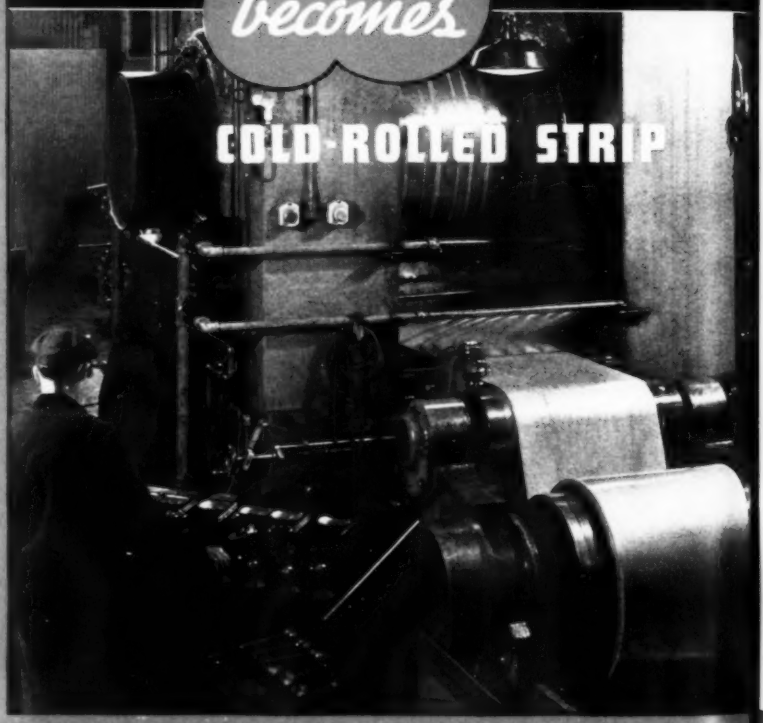
NO OTHER RACEWAY FOR WIRING CAN GIVE YOU *all* THESE FEATURES

- Cold-Rolled Open-Hearth Steel
- 100% Electric Resistance Weld
- Adequate Protection
- Light Weight
- Easy to Cut
- Easy to Bend and Rebend
- No Threads
- 3 Simple Fittings
- Knurled Inside Surface
- Uniform Corrosion-Resistance
- Easy to Install
- Universal Acceptance
- Low Cost
- Widespread Distribution
- Assistance of a Field Force



becomes



ELECTRUNITE Steeltubes

Reg. U. S. Pat. Off.

MORE THAN 150,000,000 FEET INSTALLED

And then—a better raceway for wiring

From the open-hearth, where close control makes finer steel, comes the steel for ELECTRUNITE Steeltubes—steel that is uniform, tough and highly ductile.

To produce the strip used in electric resistance welded ELECTRUNITE Steeltubes, the steel is rolled *cold* to the desired width and gauge. In this way strip is produced which is uniform in thickness—which means uniformity in wall of the tubing. Cold rolling improves the fine-grained structure of the steel, makes it easy to bend and produces a smooth, dense, scale-free surface that is resistant to corrosion. Even the knurled inside surface is cold-rolled into the steel.

This better steel and more careful methods of rolling do not make ELECTRUNITE Steeltubes cost more. Through electric resistance welding and elimination of excess weight and threading, genuine ELECTRUNITE Steeltubes—with all necessary fittings included—costs less than old-style conduit and no more than imitation brands that do not offer all its advantages.

Positive protection to wiring at lower cost means increased outlets, higher profits and more jobs. Ask your electrical wholesaler for figures. If he doesn't stock genuine ELECTRUNITE Steeltubes, write us for full information and the name of your nearest distributor.

* * *

Knurled inside finish (patent No. 1,962,876) available in ½", ¾" and 1" sizes.

ELECTRICAL DIVISION

Steel and Tubes, *Inc.*

WORLD'S LARGEST PRODUCER OF ELECTRICALLY WELDED TUBING

CLEVELAND . . . . OHIO

SUBSIDIARY OF REPUBLIC STEEL CORPORATION

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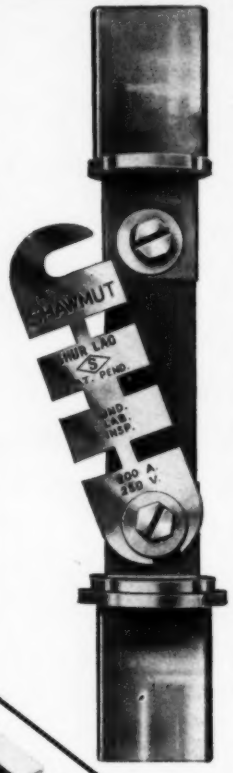
SHAWMUT
SHUR-LAG
RENEWABLE
FUSES

PROTECTION



With Shur-Lag Renewable Fuses, greater time lag under unusual overloads gives ample protection — without the unnecessary annoyance and expense of frequent "blows". When protection is *really* needed, Shur-Lags do the job.

Write for literature giving complete specifications and prices.

THE CHASE-SHAWMUT CO.
NEWBURYPORT, MASS.
FUSE SPECIALISTS SINCE 1893

Pressure Switch Prevents Overheating

A pressure switch on a cooling water system in a large foundry prevents the overheating of air-compressor cylinders due to lack of sufficient water.

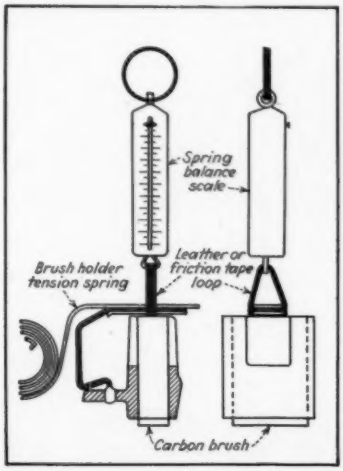
Water is pumped from the tank of a cooling tower to air compressors and recirculated. City water also can be used for cooling by a connection, ahead of the pressure switch.

When the water pressure drops twenty pounds or more, the pressure switch opens an electric control circuit to the main line contactor, disconnecting the air compressor motor from the line.

The electrical connections also provide for sequence starting of the circulating pump and air compressors. First, the pump motor is started and water is circulated through the air compressor cylinders. After the water pressure builds up to a predetermined value, the pressure switch closes a connection for the push button control. Then by pressing a "start" button, the 2,300-volt circuit is closed and the air compressor motor is started.

To Measure Brush Pressure

Measurement of motor brush pressure can readily be made by using an ordinary spring balance scale. The scale can be made more suitable for this work if the hook is replaced by a leather loop. Or, a short loop of friction tape may be used by placing it over the hook on the scale and under the pressure finger on the brush holder. Either arrangement provides a secure grip of the pres-



BRUSH PRESSURE MEASUREMENT *—Exert pull on spring scale parallel to and over the brush, taking reading when contact tip is at top of brush-holder.*

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"it's Checkup Time"

for SERVICE STATIONS

TAKE your Benjamin Manual "What Every Service Station Operator Should Know About Lighting" and compare your station lighting with the lighting layouts shown in this book. Before you go into your busy season satisfy yourself that you've done everything possible to increase your business with light. Perhaps you need another Benjamin Duo-Service Floodlight, Column-Lite or Service Lite—but whatever your checkup shows you need, get it. The best investment you can possibly make to increase gallonage is good lighting.

You are sure of getting this good lighting when you purchase or specify Benjamin equipment. It is especially designed for Service Station Lighting by Benjamin Illuminating Engineers based upon their experience in floodlighting thousands of service stations.

If you haven't received your copy of the Benjamin Manual for Service Station Operators, a free copy is yours for the asking . . . just mail the coupon below. Then call your local electrical contractor or your local light and power company and learn how inexpensive it is to have your station properly lighted. Benjamin Electric Mfg. Co., Des Plaines, Illinois.

Benjamin
DUO-SERVICE FLOODLIGHT

This patented 2-in-1 Floodlight has (1) an inner floodlighting projector which SPOTLIGHTS THE BUILDINGS and (2) a diffusing reflector which FLOODLIGHTS THE GROUNDS. Floodlighting with Benjamin 2-in-1 Duo-Service Floodlights costs no more—often not as much—as less effective lighting.

Benjamin
COLUMN-LITE

Essential to the proper lighting of pump islands and the merchandise displays at the island. Increases station attractiveness, speeds service, increases sales and profits. A Porcelain Enameled, weatherproof fixture, available in choice of colors.

Benjamin
SERVICE-LITE

A handy, telescoping, portable, work light which is particularly useful for lighting touch up, repairing, washing and polishing operations on motor cars. Every service station should have one.

BENJAMIN
TRADE MARK
LIGHTING EQUIPMENT

ELECTRICAL CONTRACTORS

This is one of the series of Benjamin advertisements appearing in the leading service station magazines. It is a part of Benjamin's comprehensive sales promotion program to help you sell more floodlighting and other lighting equipment to service stations. Write for details.

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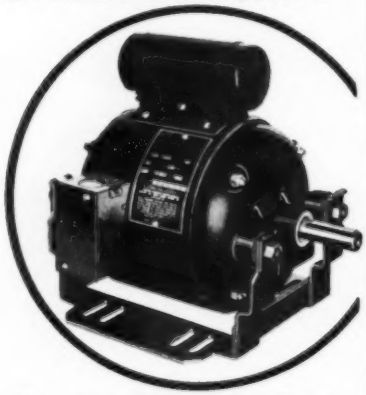
Two NEW MOTORS by Peerless

Backed by years of experience in meeting the needs of motors for general and special applications, Peerless introduces two motors.

Splash Proof

Single and polyphase motors with special hood construction permitting ventilation but excluding moisture. These motors are suitable for use in dairies, pump houses, garages and other installations where excessive moisture and dirt may prevail.



Two Speed Capacitor Start Induction Run Motors

Resilient mounted motors furnished in ratings of one-sixth to one-half horsepower. High speed 1750 r. p. m.; low speed 1150 or 850 r. p. m.

Speed changes are obtained by a simple three point switch or automatic control, providing speed control for belted blowers, fans and similar installations. Wound for long hour service, these motors have low starting current and normal starting torque.

Write for complete information and data sheets.

THE PEERLESS ELECTRIC CO.
WARREN, OHIO

sure finger when lifting it to measure the spring pressure.

When the measurements are being made the following instructions should be observed:

1. Place the loop on the pressure finger and directly over the top of the brush at the center.
2. Pull in a straight line, parallel with the brush, as shown in the sketch, and not at an angle.
3. Measure the tension when the contact tip on the pressure finger is in a position corresponding to the top of a new brush.
4. The tension on brush-holders on the under side of a commutator or collector should be increased by a value equal to the weight of the brush being used.
5. The spring tension on the various types of machines should be adjusted to the following values:

Types of Machines	*Pounds Tension per Square Inch Cross-Section of Brush*
General purpose d.c. motors and generators	2
General purpose a.c. motors	2.8 to 4
Crane type motors	3.5
Railway type crane motors	4.5
Mill Type Motors	4.5
Rotary Converters:	
commutating end	2 to 2.5
collector end	2.5 to 3
Large low-speed power machines	1.5 to 2.5
Large induction motors.	2.5 to 3.5

(Values according to Westinghouse Electric and Mfg. Co.)

In the Mail

Dear Editor:

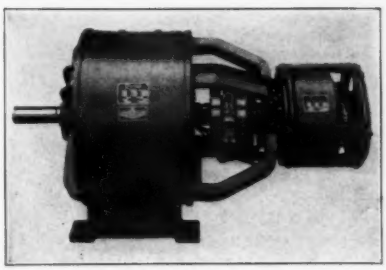
In your recent chart Trouble Shooting on Motors, you fail to mention how low voltage as a cause of motor overheating. As an example, I give you my findings on a motor case.

This motor, rated 15 hp. 220 volt three-phase, is used on centrifugal pump at steady load. It overheated and caused the thermal cutout to function. I found it to be taking 48 amperes per phase, at 208 volts.

The motor operated at approximately 5.5 per cent below rated voltage. (220 minus 208, divided by 220, multiplied by 100 per cent equals 5.5 per cent.) As output varies as the square of the voltage, the motor developed 13.35 hp. at 220 volts. (100 per cent minus 5.5 per cent equals 94.5 per cent, this squared and divided by 100 per cent equals 89 per cent, and 15 hp. multiplied by 89 per cent equals 13.35 hp.)

The readings taken showed the motor developed 18 hp. and operated at an overload of 4.65 hp. or 34.8 per cent, whereas, if the motor operated on 220 volts and developed 18 hp. it would be overloaded 20 per cent. The change of voltage was caused by the power company changing from three-phase three-wire delta connection to three-phase four-wire Y-connection.

R. T. Ryder
Pleasantville, N. Y.



For Better Service...

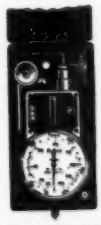
Columbia A.C. Generators have that sturdy, clean-cut appearance which only modern design and precision manufacture can give. And they are easy to sell. Sizes range from 1 to 100 KVA, single or three phase and with speeds suitable for direct connection or belt drive to gasoline or Diesel engines. May we explain our liberal dealer proposition to you?

COLUMBIA ELECTRIC MFG. CO.
4501 Hamilton Ave., Cleveland, Ohio

COLUMBIA
A. C. GENERATORS

DON'T FAIL *to maintain the* R.P.M. *and* F.P.M. *in your plant*

Bulletin No. 505EC tells about Standco Speed Indicator.



Bulletin No. 226EC gives full details on the latest Dr. Horn Hand Tachometer.

They are the keys to production. Avoid loss of production due to slow speeds and feeds, or excessive wear because of abnormal high speeds by checking your speeds and feeds with one of these handy and accurate instruments.

Use this coupon for your copies of bulletins.

HERMAN H. STICHT & CO.
Dept. EC—27 Park Place, New York, N. Y.
Send Bulletins 226EC and 505EC relating to Hand Tachometers & Speed Indicators.....
Name .....Position.....
Firm .....
Address .....
.....
Elec. Cont. 5-37

Cable Lengths For Maintenance

Among essential items provided for the maintenance crew in a plant recently visited by the editor are two 300-ft. sections of four-wire flexible electric cable. These sections are used separately or in series for supplying three phase, 220-volt current. The fourth wire is for a ground connection.

Power is supplied by the cables to portable conveyors or centrifugal pumps. The conveyors save time when loose material is to be handled. The pumps are used for pumping out excavations, underground flues or tunnels, or drying up barges. The cables are often used on 110-volt circuits. For 220 volts a standard plug is used, but for 110 volts the cable is tapped near the plug and hooked in on a service switch.

Here's an example of how this equipment saves time, labor, and money: A railroad trestle had to be repaired in the yard and at a considerable distance from the nearest current supply. The two lengths of cable were connected in series. By tapping in a weatherproof socket at the other end of the cable and attaching an extra cord to the drill, it was possible to use the drill at a distance of 700 ft. from the supply. The time saved in drilling the holes in the wooden stringers for this one job would go a long way toward paying for the cables.

The Schedule's The Thing!

Substantial savings in the power bill have been realized in the plant of the Hood Rubber Company, Inc., Watertown, Mass. It was accomplished quite simply.

Some of the departments, operate 24 hours a day. So some processes, which consume large quantities of power, are carried on during the back shift (from 11 P.M. to 7 A.M.) when the use of power is otherwise at a minimum. Thus, by keeping some of the heavy machinery idle in the daytime when the power load is high, the 24-hr. curve of power consumption is materially flattened. The demand charge on the power bill has been greatly reduced, and the saving is practically net except for some extra supervision.

In planning the schedule, processes which were transferred to the back shift were so selected as to avoid an upset of daytime operations. The production department cooperated in scheduling the operations so that enough process could be carried on at night to effect a worth-while saving.

OF ALL DAYS TO BALK— WASH DAY!
THEY NEED YOU AND AN OHIO CARBON BRUSH

Tragedy in the basement! It means a lot to Mrs. Housewife, but you'll see in a minute that all that is needed is the right Ohio Carbon Brush from the wide variety which (if you're profit-wise) you always carry in stock.

Ohio Carbon Brushes can always be counted on for consistent quality, long life, and customer satisfaction.

THE OHIO CARBON CO.
12508 BEREA ROAD • CLEVELAND, OHIO

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DEPENDABLE

With High Intensity Mercury Vapor Lighting accepted by the largest manufacturers in the country, it is time that every factory, mill, foundry, and shop investigate this new and better lighting method.

High Intensity Mercury Vapor light cuts down accident risk—increases working efficiency—cuts the cost of lighting.

DONGAN TRANSFORMERS are built for this purpose by transformer specialists — by the same people that have been building the DONGAN line since 1909.

While it costs you no more to use DONGAN TRANSFORMERS on your installations, it will pay you to install them because they will give you a cooler, cleaner, and more DEPENDABLE installation.

DONGAN ELECTRIC MFG. CO.
2985 Franklin St., Detroit, Mich.

Please send more information on—

☐ Mercury Vapor Transformers
☐ General Transformer Line
☐ Supplementary Machine Lighting Transformers

Name .....

Address .....

City ..... State .....

Keeping Electric Tools in Shape

By John S. Hand

Service Manager
The Black & Decker Mfg. Co., Towson, Md.

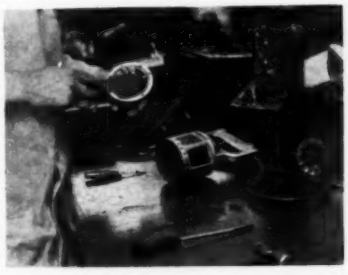
The general care of portable electric tools can readily be assumed by the user or a competent maintenance man. Such care includes cleaning, greasing, renewal of carbon brushes and cable replacement. But even though such attention is not difficult, it is often neglected and can easily result in delaying an important maintenance or production operation.

By periodically inspecting these tools, repair expense will be held down and more efficient work with the tools will result. This periodic inspection should cover the following operations:

1. Renew grease in gear case and armature bearings.

Remove gear case and wash out all old and dirty grease, using suitable fluid. The gears, bearings and other parts can then be inspected for wear. In reassembling, the underside of the gears should be coated with grease and the case should then be packed one-half full, using a good grade of medium grease such as "Non-Fluid Oil A-#3", or equal.

It is important to remember that grease expands with heat and that too much grease put into the gear case of a portable electric tool invariably results in the generation of excessive heat in the gear compartment. It is also possible, where too much grease is used, that the grease might force its way through the bearing into the ventilating fan and the motor field, where it sometimes causes serious damage.



FRESH LUBRICANT—Gear case of portable electric tool repacked one-half full with a good grade of medium grease.

2. Inspect carbon brushes and commutator.

Generally there are two types of carbon brushes used in portable electric tools, one known as "cartridge-type" and the other as "flat" or "box-type." Remove the brushes, inspect for wear and thoroughly clean, so that they will slide freely in the brush-holders. Brushes allowed to wear to within one-third of their original length will usually cause open or short circuits in the armature. The reduced spring tension allows the brush to make infrequent contact with the commutator.

This causes violent flashing and the generation of an excessive amount of heat, which usually throws the solder from the commutator bars, causing an open circuit and making necessary the installation of a new armature. At least 75 per cent of motor failure in portable electric tools can be traced to worn brushes, so it is wise to give them the proper attention.

***BRUSH INSTALLATION**—Cartridge type, inspected for wear and cleaned to prevent sticking in brush-holders.*

3. Clean the accumulation of dirt from all ventilating holes and slots.

4. Inspect cable for breaks.

5. Inspect and tighten switch connections.

6. Wash accumulation of chips and dirt from chuck jaws.

7. Tighten all screws.

When a tool fails to operate, check for the following:

a. Brushes not making contact.
b. Broken motor lead.
c. Broken cable.
d. Switch not making contact.
e. Open circuit in armature.
f. Open circuit in field coils.

For the use and convenience of their customers, principal electric tool manufacturers maintain factory service branches located at strategic points throughout the country. These branches are manned by a personnel trained in the repair and maintenance of these tools. By sending major repair jobs to factory service branches, the investment in these tools is safeguarded and satisfactory performance guaranteed.

Bulletin 709, Size 2, solenoid starter. Note the compact switch mechanism, white interior, ample wiring space, and accessible terminal connections.

"No use, Philbert— that magnet is too strong!"

Even Philbert's tractor can't open the solenoid magnet on an Allen-Bradley motor starter once full line voltage is applied. More than that, even with a considerable drop in line voltage, the solenoid remains closed. With low line voltage, Allen-Bradley solenoid starters "pull in" with positive action and close tightly —there is no chance for welding of contacts.

Allen-Bradley solenoid starters cannot close accidentally due to jars or jolts. The absence of pivots and bearings reduces friction to a minimum and thereby automatically speeds up switch action. Where line voltage conditions are poor and voltages vary, these solenoid starters are the logical choice. Specify Allen-Bradley solenoid starters for all-around reliability.

A-B

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

UMI

YES! They are silver alloy contacts

but-

WHAT OF IT?

"Maybe the contacts of Allen-Bradley starters are made of patented silver alloy—but, as a user of motor control equipment, what does that mean to me?"

1st—NO CONTACT MAINTENANCE

Oxides that form on these silver alloy contacts will conduct current as well as the metal itself. There is no need to clean or "dress" these contacts. They always remain in first class operating condition.

2nd—LONG CONTACT LIFE

Ordinary copper contacts must be filed if they are to be kept in working condition. With Allen-Bradley silver alloy contacts, this is entirely unnecessary. Hence, no valuable contact life is wasted by filing.

3rd—GREATER CURRENT INTERRUPTING CAPACITY

— The patented silver cadmium alloy used in Allen-Bradley contacts has a strong deionizing effect and helps to snuff out the arc. Hence, these contacts will interrupt high currents with much less difficulty than pure silver contacts.

Send for New 24-Page Booklet

Allen-Bradley Co.,
1307 S. First St., Milwaukee, Wis.
Please send me your new booklet, "The Story of the Solenoid Starter."

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Company .....

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City ..... State .....

ALLEN-BRADLEY MOTOR STARTERS
(up to 30 hp, 220 v—50 hp, 440-550 v)
HAVE DOUBLE BREAK SILVER ALLOY CONTACTS

BULLETIN 609

Hand operated across-the-line starting switches for squirrel-cage motors. Exceptionally rugged. Maximum range 5 hp, 220 v; 7-1/2 hp, 440-550 v. Thermal breakers give overload protection.

BULLETIN 709

Automatic solenoid type starting switches for squirrel-cage motors. Three forms, three sizes. Oiled tower enclosing cabinets. There is no substitute for these dependable starters.

BULLETIN 740

Automatic-resistance starters for squirrel-cage motors. Provide stepless acceleration without violent current inrushes. Have adjustable Bradleyunit resistors and solenoid contactors. Operated by push buttons or other pilot devices.

BULLETIN 712

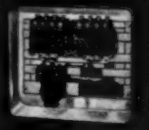
Combination across-the-line motor starters with hand operated line connection. Both units are assembled in one cabinet. Can be furnished with circuit breaking. Clearly simplifies installation. Hundreds of plants are standardizing on these starters.

BULLETIN 705

Automatic reversing switches for two or three-wire pilot control operation. Pilot start. Equipped with mechanically interlocked solenoid contactors. Six types of enclosures.

BULLETIN 715

Automatic multi-speed across-the-line switches for consequent pole or separate winding motors. Two-speed, or four speeds. Four sizes. —all reasonably compact.



A-B Allen-Bradley

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

UMI

More GOSSIP

Job Identification

Each repaired motor that goes out of the Reserve Electric Co.'s shop at Cleveland is stamped with a series of numbers to identify it if it should come back in the future. This number permits quick identification and reference to the old work records.

Lighted Crossings

The Niagara Junction Railway Co., a terminal switching railroad in Niagara Falls, N. Y., will use 24 sodium luminaries to light eight city grade crossings and four private crossings in the vicinity of various industrial plants which it serves. Two units at each crossing will illuminate approaches, the yellow sodium vapor light also serving as a caution signal.

Rigid Tests

Refrigeration motors must perform satisfactorily at 200 per cent starting overload before they pass muster, under the final test procedure that is followed in the service shops of the S. J. O'Brien Sales Corp., New York, N. Y.

Shop Promotion

The Electrical Installation Co. of Cambridge, Mass., believes that industrial customers can be made to appreciate the finer points involved in quality motor reconditioning work. So they are compiling a photographic presentation of their methods. Close-ups of cleaning, stripping, stator-cell insulation, impregnation, and other operations are being illustrated and explained.

Wired Pigs

Up in Toronto, where Red Seal reigns, they wire for "electric pigs," which George W. Patterson of Patterson Electric, Ltd., tells us is the local term for motorized garbage grinders, built into modern kitchen sinks.

Frankly Speaking

If you do good work, why keep it a secret? The Queen City Electric Repair Co., of Cumberland, Md. doesn't. Its truck is neatly lettered: "Electric work as it should be done."

Range Hook-up

The average range in general use around Buffalo is of 10 k.w. capacity. W. G. Bettendorf, of Bettendorf Electric Co., uses a new hook-up in which the 60-amp. range fuses are in multiple with 60-amp. main lighting fuses. He has found that it solves all normal cases of fuse blowout trouble.

Check Capacitors

Capacitor-start motors present such tricky connecting problems to the average motor winder, warns L. B. Anthony of the L. B. Anthony Co., West Lynn, Mass., that it behooves shopmen to be conservative in estimating repairs on this type of small motors.

MERCHANT CONTRACTORS—One of West Virginia's finest layouts is the Charleston headquarters of Schoolfield-Harvey Electric Co. Here, L. P. Harvey (left) and R. R. Schoolfield greet their commercial, industrial and residential customers with a typical below-the-Mason-Dixon-Line courtesy. When Mr. Harvey came into the business 16 years ago, his University of Alabama electrical training fitted him for the engineering side, yet these men are successful electrical merchants as well.

Carrying Ladders

Electricians will avoid serious trouble, while working around busy corridors, if they carry no pipe or ladders on their shoulders. There are few less painful places to bump a dreamy hall pedestrian with a piece of conduit than in the face, says Foreman Sievert of the Northwest Electric Construction Co., of Erie, Pa.

Start Them Young

"Who knows where vocational school boys will be in industry?" asks C. F. Crowder, vice-president of the H. N. Crowder Jr. Co., Allentown, Pa. Since many of them will later become responsible employees in local industries, these young fellows were given special consideration, when a group of 50 such students came out by invitation to the company's recent 25th Anniversary Industrial and Power Show.

DON'T miss
the valuable
JUNE ISSUE
of
ELECTRICAL CONTRACTING
with editorial feature section
"TOOLS on the JOB"
containing

1. Tooling to cut costs
2. Tool economies on conduit work
3. Handling EMT, fibre, underfloor
4. When you pull wire and cable
5. Special tools for odd jobs
6. Who makes tools

Also in June

- "THE MID-TUNNEL JOB" Wiring and equipment in the 38th St. Tunnel under the Hudson River. A spectacular engineering feat.
- "NEW LIGHTING FOR STORES"
- "ELECTRONIC CONTROL"

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Questions ON THE CODE

Answered by F. N. M. SQUIRES

Chief Inspector New York Board of Fire Underwriters

Grounding of Motors

Q. *ON a 3-wire a.c. 110-220 volt circuit, where there is less than 150 volts to ground, do small motors and switch boxes have to be grounded? Switch boxes are the two-pole enclosed safety type, usually installed on wood in barns and small outbuildings.*

The recommendation in Abbott's Handbook, Section 1306, I think, is not a requirement, as it does not say "shall be."—W. R.

A THE National Electrical Code does not require that the frame of a motor operating on a 3-wire a.c. 110-220 volt system having a grounded neutral be grounded provided it can be permanently and effectively insulated from the ground. This is found in rule 1006-b. The code does recommend that all motor frames be grounded, and this should be done wherever possible.

But rules 1006-c, 905-a, 5, and 1202-d, do require that controller cases and switch and circuit breaker enclosures be grounded unless they are accessible only to qualified persons. (But most qualified persons will want these enclosures grounded for their own protection.)

Around the average barn and outbuilding there are generally many others than qualified persons. The above rules would therefore require that the controller cases and switch boxes be grounded.

Lights from Elevator Control Wires

Q. *Does the Code permit lights in elevator cars to be connected to the control wires of the elevator cable? —B. W.*

A. The Code does not permit lamps, appliances, or other current consuming devices to be connected to motor control circuits. This is found in rule 2003-a, which provides that ". . . . every lamp, motor, electrically heated appliance or other device consumming electrical energy shall be supplied by a branch circuit of one of the types specified in the following sections . . . ." and a motor control circuit is not among those enumerated to which lampholders may be connected.

Another reason is that due to the particular service or duty which control circuits perform they are often exempted from the requirement calling for overcurrent protection. Interposing lamps on such circuits would be subjecting these circuits to other duties than that for which they are intended and to duties which would require the inclusion of overcurrent protective devices.

ENGINEER-CONTRACTOR — The Charleston, W. Va. telephone directory carries a classified listing: "Engineers-Electrical" and then the firm name, Rosenblatt & Hunt. And here is Arthur M. Rosenblatt (M.I.T.). He does engineering for various architects and industrials in that locality as part of a general business which includes contracting and air conditioning. Two air conditioning engineers and five salesmen are helping him scientifically condition the air in the business buildings of Charleston and neighboring cities.

Private Plant Circuits

Q. *In the case of a motor boat private generating plant and storage battery system of 32 volts, what size circuit wires must be used to supply six or eight 40-watt lamps?—G. A. N.*

A. The Code is not generally considered as applying to electrical work installed on ship board, altho, some of its provisions have been applied by some inspection authorities when requested to inspect work installed on boats.

Of course, if the provisions of the Code are applied to the above question the appropriate rules are found in Article 40.

This would require the use of wire not smaller than No. 12 for the circuit wire, and if not more than eight 40-watt lamps are to be used, these may all be placed on one circuit.

Trial Cable Installations

Q. *In regard to the question on the Code, in the March issue of your magazine, covering the use of so-called "C N X" cable, provision No. 3, would you please answer these questions?*

In limiting this cable to use for systems with an electrically continuous metallic underground water piping system, does this include isolated residences and, farm buildings with their own water pumping systems?

Is it possible under the Code ruling to use a CNX cable under any conditions with a driven ground?—D.R.A.

A. There is no rule in the National Electrical Code permitting this type of wiring. The only rule covering the installation of a somewhat similar type of cable, is found in 513a, wherein we find that for electric *"range circuits only"* an approved service entrance cable with an uninsulated grounded conductor may be used providing the cable has a final "non-metallic outer covering" and this type of cable (S.E.) may not be used for any wiring other than for ranges or service entrance work.

The recommendations mentioned in our March issue, were those of the Electrical Committee. N.F.P.A., but not a part of the Code. They were issued for the guidance of inspection authorities where they grant special permission for trial installation under controlled conditions. In such cases, however, the "electrically continuous water piping system" means a metal water piping system running under-

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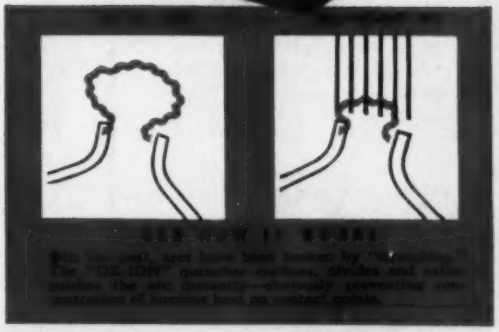

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1930	$ 225,600	$ 225,600
1931	9,013,400	9,239,000
1932	1,183,600	10,422,600
1933	409,500	10,832,100
1934	773,100	11,605,200
1935	12,361,300	23,966,500
1936-7	8,371,700	* 32,338,200

*SAVINGS TO OUR CUSTOMERS IN 1937

$32,338,200

THUS, our electric and gas customers in New York City and Westchester are saving $32,338,200 in 1937, compared with what they would have paid in 1929.

Although the record is clear, we have tried to make certain that the public knows it as well. For this or any company, the policy of "letting others know" is often as essential to satisfactory progress as the matter itself.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
AND AFFILIATED COMPANIES

Electric, Gas, and Steam Service for Business and the Home

Questions ON THE CODE

[FROM PAGE 44]

ground from house to house along a street or several streets.

It does not include the water piping of isolated residences or farm buildings with their own water pumping systems, even when connected to driven deep wells, nor does it include nonmetallic street water piping systems nor even cast iron water piping systems with oakum caulked joints in which there is no electrical connection between adjacent lengths. Nor does it include water systems such as often found at some summer bungalow colonies where some pipes are run under ground, and some over or on top of the ground.

Shock Mystery

Q. I have been called in to repair an electric equipment in a house which job just about has me stumped. Can you help me?

The lady of the house called me in to repair the circuits as she was getting shocks from the electric fixture in the kitchen and also from the gas range and the water faucets. Upon tests I decided that the trouble was due to static electricity generated from walking over a new linoleum floor covering. I advised the lady not to worry about it as it could do no harm but was only slightly uncomfortable at times. However, a couple of weeks later I was advised that the linoleum had been taken up and put away in a closet but that the same trouble existed. Another contractor who was called in claimed he could eliminate the trouble but that his bill would be $30. *Can you advise me what the trouble is and how to rectify it?*—A.B.

A. Investigation indicated that when the new linoleum flooring was purchased the tenant also purchased a new set of kitchen furniture having highly polished varnished surfaces. At the time of investigation the linoleum had been removed from the floor but the static continued. While the static may have been noticed after taking a few steps across the linoleum it now was present only after someone had sat in one of the new chairs. The occupant was thus convinced that the trouble was not due to the electric wiring but truly was static electricity.

A further checkup is being made with the furniture manufacturer to as-

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*** The No. 375**

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Sell quality and eliminate costly service calls.

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STRONG DISTINCTIVE GREEN CORE
COLORFUL ATTRACTIVE BOXES
PERFECT ADHESIVENESS and TENSILE STRENGTH
Made by A COMPANY IN THE INSULATION BUSINESS SINCE 1878
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- Quick methods for correcting both motor and generator troubles—
- Clear directions for proper installation of motors and generators—
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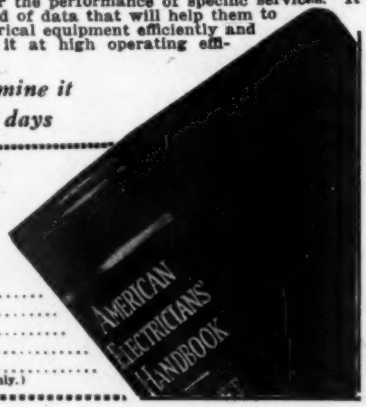
Examine it 10 days



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Questions ON THE CODE

[FROM PAGE 68]

certain the grade of wood used and also the kind of varnish employed with furniture which gives this effect. Possibly a way may be discovered which will result in the elimination of the generation of static from these causes.

D.C. Plant Problem

Q. I am a subscriber to your trade paper and would like an answer to the following question:

I have four generators 110 v. d.c., one 300 kw., two 150 kw., and one 75 kw., total 675 kw. This system is not a grounded system, but the owners of this plant want the negative grounded to earth. There is a 3-in. water main coming in from the street for making the grounding connection. What would you suggest relative to size of copper from back of switchboard, which is straight two-wire 110 v., to all points of distribution?—B. E.

A. Our correspondent did not clearly state whether he desires information as to size of the feeder conductor, or the size of the proposed grounding conductor.

If it is for the size of the feeder conductor, we must assume, due to the lack of more definite data, that the load equals the generating plant capacity, and this is computed as follows:

675 kw. ÷ 110 volts, = 6137 amps. This would require 6 — 2,000,000 c.m. conductors per leg if rubber covered conductors were used, or six 1,100,000 c.m. conductors per leg, if bare, or of heat resisting insulation.

If the inquirer desired to know the size of a proposed grounding conductor for this system, we refer to rule 908-h of the Code. The size of a grounding conductor for a system, is required to have a current carrying capacity of not less than the carrying capacity of the largest conductor supplied by the system. This would thus require the use of six 1,100,00 c.m. bare conductors.

Possibly the inspection bureau having jurisdiction might grant special permission for the use of a smaller conductor, as there is probably no additional benefit gained in providing greater capacity in this grounding conductor than is to be found in the 3-in. water pipe to which the grounding conductor is attached.

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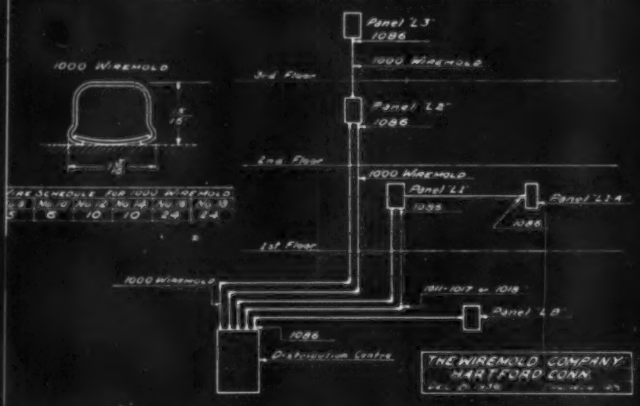
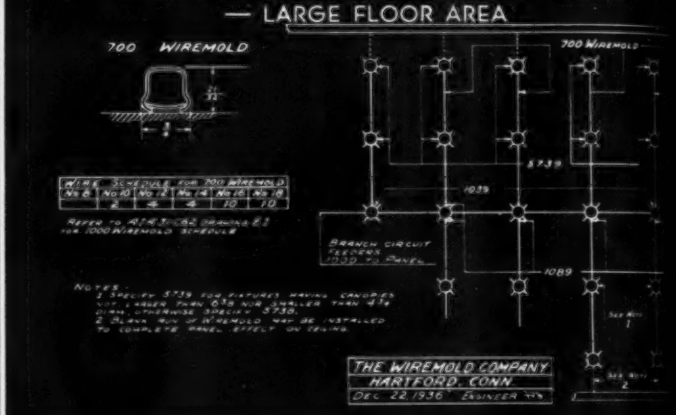
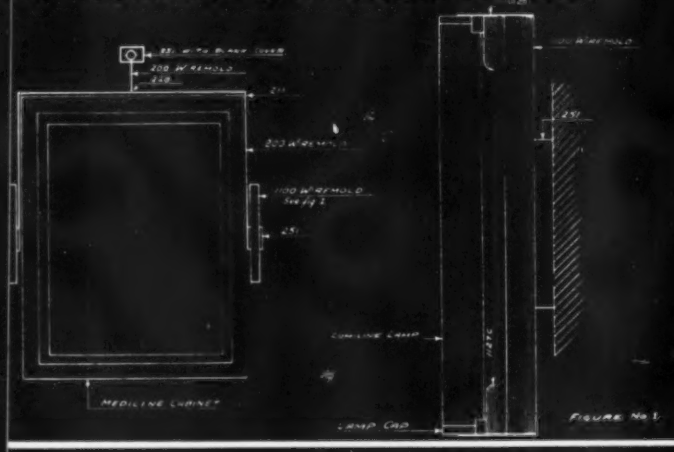
E1—FEEDER AND RISER LAYOUT



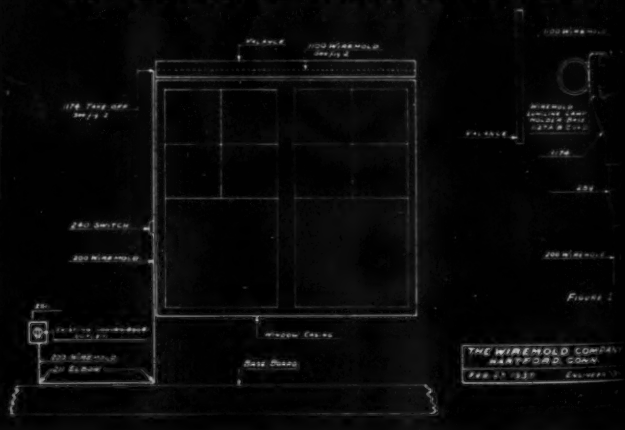
E2—BRANCH CIRCUIT LAYOUT — LARGE FLOOR AREA



E5—LUMILINE BATHROOM LAYOUT

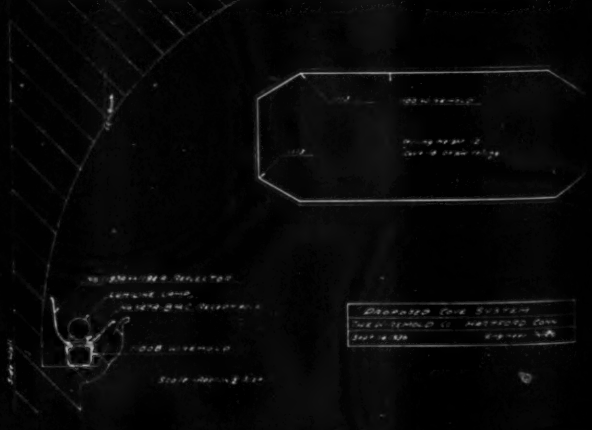


E6—LUMILINE VALANCE LAYOUT



ES1—MAZDA LAMP COVE LAYOUT

ES2—LUMILINE LOBBY LAYOUT



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ES 2	☐
ES 3	☐
ES 5	☐

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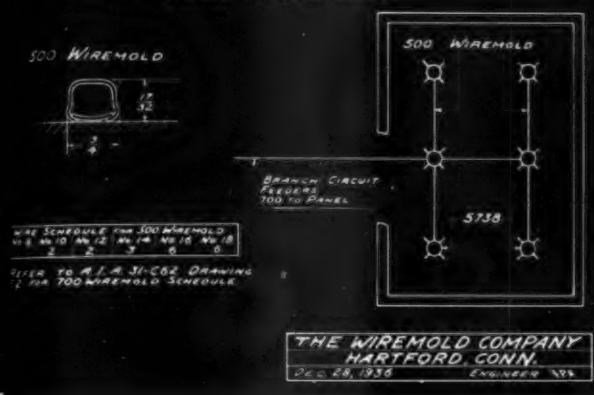
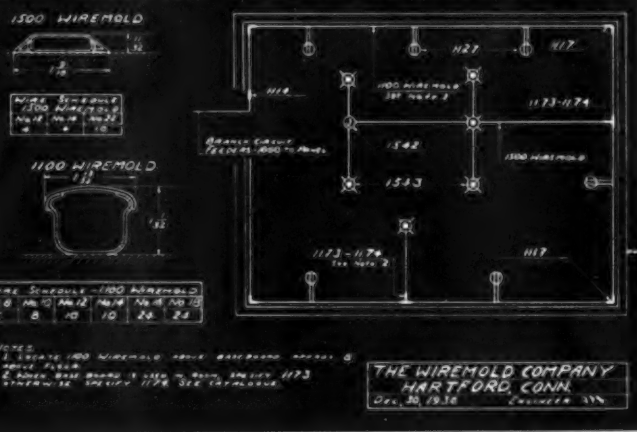
NOTE—These are merely suggestive sketches—to be utilized by contractors, engineers and architects—in preparing their own working drawings.

E3—BRANCH CIRCUIT LAYOUT — SMALL FLOOR AREA

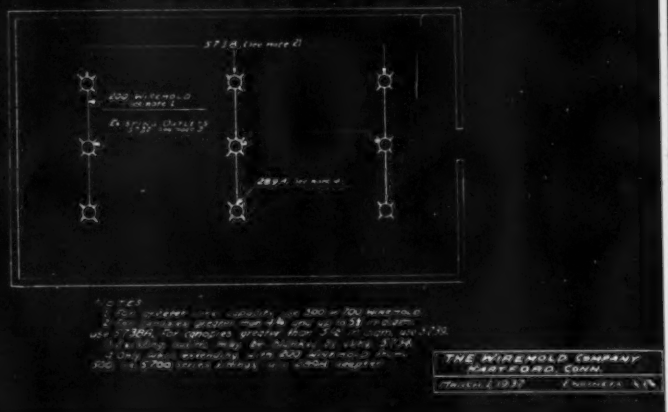


E4—WALL & FLOOR OUTLET LAYOUT



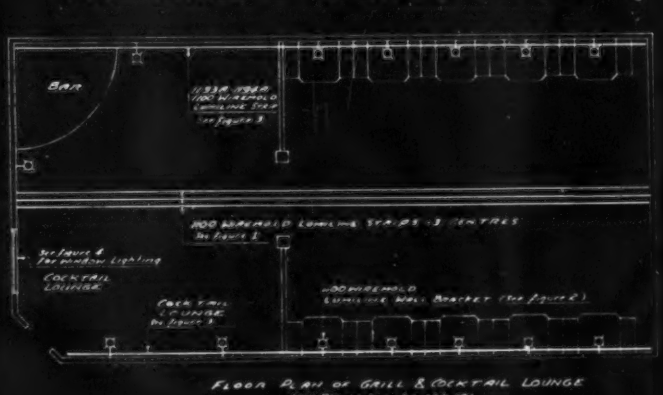
7—LUMILINE LIVING-ROOM LAYOUT

E8—CEILING OUTLET LAYOUT



ES3—STORE & WINDOW LAYOUT

ES5—GRILL & LOUNGE LAYOUT



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Questions on SIGNALLING and COMMUNICATION

Answered by ALBERT A. SCHUHLER

Adding Transmitter to Fire Alarm

Q. *An industrial concern has a plant equipped with a closed-circuit, plain code, fire alarm system, using pull lever stations, and single-stroke bells. They feel that an improvement can be made by including a centralized control, to enable them to send out any code from the power house, which is now transmitted by the present fire alarm stations. What equipment would be required to do this work, and how is it connected into the system?—C.D.*

A. This result may be obtained by installing what is generally known as a manual code transmitter. It consists chiefly of a spring wound, pull lever mechanism, with an extension shaft. A rack is provided with a complete set of removable code wheels, one for each station, plus at least one additional wheel for any special signal required.

Upon receipt of information by telephone or messenger, as to the location of the fire, the designated code wheel for that location is removed from the rack, and is placed on the shaft of the transmitter. The lever is then pulled, which action winds the spring, and actuates the mechanism. This causes the code wheel to transmit a code four complete rounds. At the end of the alarm, the code wheel is removed from the shaft and replaced in the rack. This manual code transmitter is connected into the regular fire alarm station loop, that is in series with all of the other stations.

Different Type Stations on System

Q. *In our hospital we have a number of nurses' call stations of the tumbler pull cord type. We desire to equip a new wing with the locking push button type stations. We intend to interconnect the new stations to use the present annunciators at the nurses stations, and the pilot stations in the duty and utility rooms.*

The present system operates from a 12 volt transformer, which is of such size that it will take care of the additional equipment. Will you advise whether the two types of equipment will operate together on the same system?—L.W.

A. Yes, the pull cord and the locking button types of stations will operate satisfactory on the same system. Should this be a simple system using room stations, corridor door lamp stations, nurses station annunciator and duty room stations, in which the ward rooms are piloted separately, then, the four-way type locking button stations will be satisfactory. However, should, the duty room stations have only one common pilot lamp for both ward rooms and private rooms, then it will be necessary to have five-way type stations.

In any event, since nearly all pull cord stations are of the five-way type, it would be to the advantage of the institution to purchase five-way stations at this time. By doing this, the system may be prepared for any future scheme in wiring for special piloting.

Maximum Bells and Stations

Q. *What limitations, if any, are placed upon the number of fire alarm bells and stations on 110 volt a.c. and d.c. closed circuit supervised systems?*—D.E.

A. It has been generally accepted by the manufacturers of signalling apparatus, and by ordinances in a number of cities and states and by the government departments that the amount of equipment on fire alarm circuits shall be limited as follows:

A.C. 10 bells on one circuit.
20 stations on one circuit.

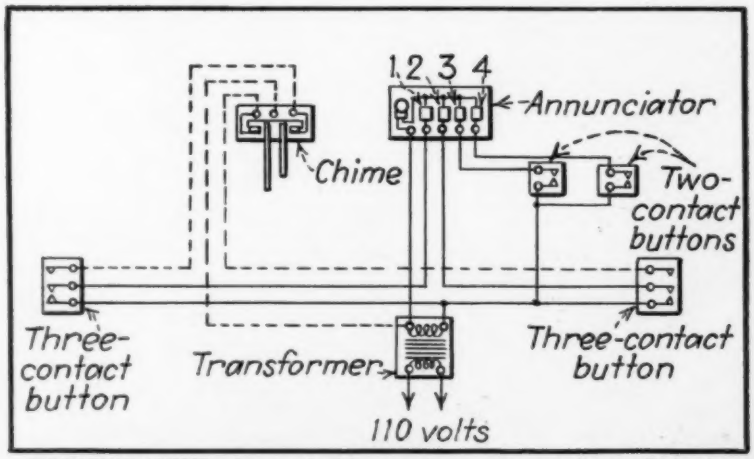
D.C. 14 bells on one circuit.
20 stations on one circuit.

The actual number of bells on a circuit is, of course, limited for electrical reasons, since in most cases they are connected in series. However, plain coded stations do not consume any current, and are simply limited in number for the sake of convenience in isolating trouble in the system.

Chimes Connected With Annunciator

Q. *A hand reset annunciator is at present being used to indicate calls made from the front and rear entrances, and from other points in a residence. The owners desire to add a tubular chime in another section of the first floor, to have distinctive tones for the front and rear door signals. How may this chime be added to the present wiring system?—V.S.*

A. The simplest way is to install a two-tube tubular chime, one tube to be used for the front door signal, the second tube to be used for the rear door signal. It will be necessary to change the push buttons at the entrances from



SELECTIVE CHIME—Connected with annunciator system to indicate calls for front and rear.

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MEAN SERIOUS DELAYS TODAY
PROTECT THEM WITH RELIABLE
TIME-TRIED FUSES
● It's not only the cost of rewinding a burned-out motor, but the serious production delays that make absolutely dependable fuse protection vital today.
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Guard against unnecessary delays by insisting on time-proven Union Fuses. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 535 College Street, Toronto.
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Renewable FUSES

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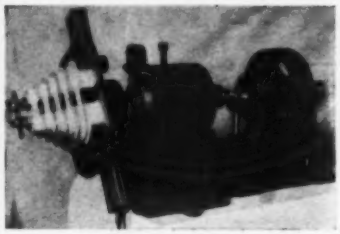

Ideal "Concentric" Coil Winding Head mounted on Ideal Coil Winder Drive, showing group of coils wound in series and tied ready for inserting in motor.

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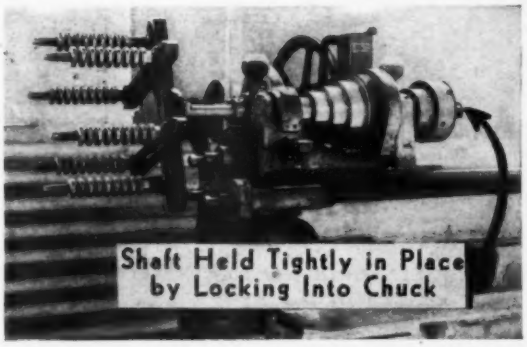
IDEAL

Coil Winding Head and Drive

Popular-sized coil winding simplified! Heads adjustable to any length or width in 5 to 10 minutes. Soldering end of each coil eliminated. First cost is low, and equipment pays for itself.

Quickly adjustable for different coil sizes and types. Simplest. Easiest to adjust and operate. Takes the place of a multitude of makeshift wooden forms.

Ask about Free Trial



Ideal "Universal" Coil Winder Head mounted on outboard end of small lathe headstock spindle. Shaft, through hole in spindle carries coil winder head and is driven by gripping in lathe chuck on opposite end.

IDEAL COMMUTATOR DRESSER CO.
1041 Park Ave. Sycamore, Illinois

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Corner View
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Only One Size Needed
Fits all wires No. 12 or smaller
The screws can't come out
All Brass—(or Bronze)
Simple and Quick

The bronze fixture connectors are made especially for outdoor use. Universally favored for Neon sign work. Made of high copper bronze—weather resisting. Construction same as the brass.

Free samples on request

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TECHNICAL APPLIANCE CORP.
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[FROM PAGE 74]

the two-contact, to the three-contact type.

If the present system operates on a 12 to 24 volts signal transformer, it is quite likely that the present transformer will be sufficiently large to take care of the extra load. In any event you will require nothing less than a 25 watt transformer to do this work.

Should the present transformer be of the small bell-ringing type, it will be necessary to change the transformer, so that you will obtain an output of 25 watts at the voltage required to operate the annunciator. Or it may be necessary to connect a similar transformer in multiple with the present transformer. As a rule chimes require a slightly higher voltage and this should be taken into consideration.

The wiring diagram shows the present circuit in solid lines, and the additional wiring in dotted lines. No changes are necessary in the present annunciator circuit.

Extension Bells for Annunciators

Q. *An institution, which at the present time uses an annunciator for door and office signals, desires an extension bell installed in a corridor to operate with the drop, to indicate calls from the main entrance.*

I have been told that it might be necessary to rewire the annunciator and install a relay to operate with the main entrance drop. After examining the annunciator, I find that there is no space inside the annunciator to install a relay.

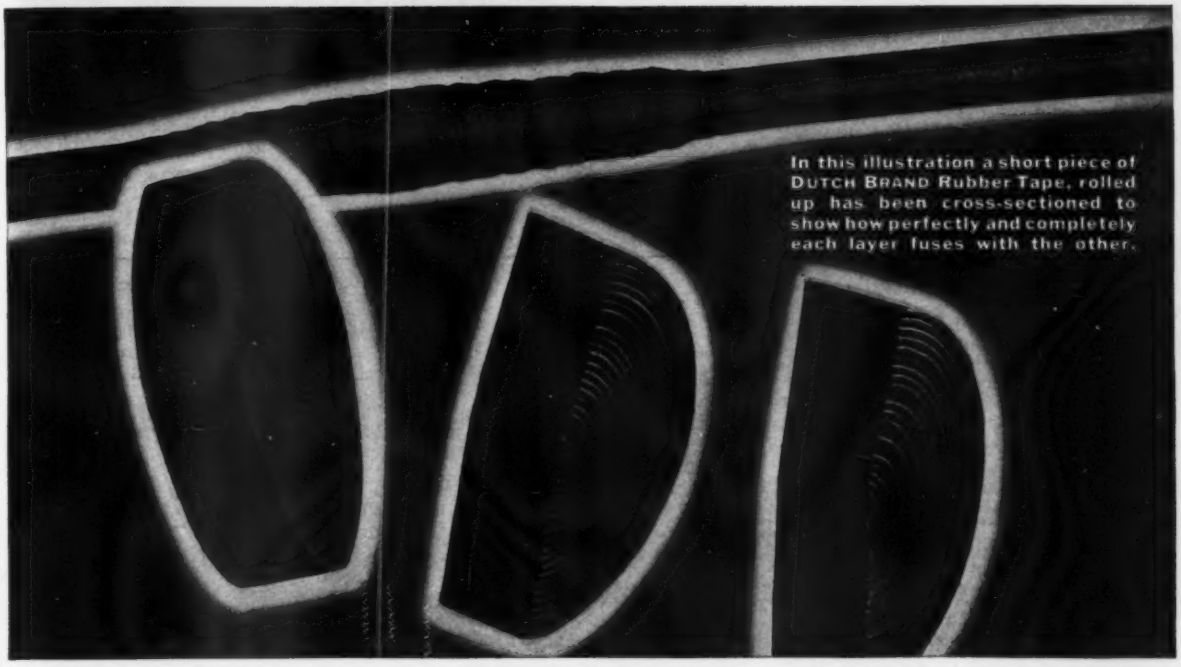
Can you advise of another way of operating the extension bell to give the results wanted? All wires are run in conduit. A heavy duty type transformer is now being used.—H.W.B.

A. The simplest way is to change the push button at the main entrance by substituting a three-contact button for the present two-contact type. A three-contact push button is one having three terminals, one of which is used for feeder wire, the remaining two wires for section wires.

The next step is to run an additional wire from this push button directly to the extension bell. Then run the feeder wire from the opposite leg of the transformer to the remaining terminal of the extension bell.

In connecting the three-contact push button, the present feeder wire is con-

REINSULATE with welded rubber


In this illustration a short piece of DUTCH BRAND Rubber Tape, rolled up has been cross-sectioned to show how perfectly and completely each layer fuses with the other.

• That's exactly what you do when you use DUTCH BRAND Rubber Tape. One layer actually welds itself to the other and the result is one solid piece . . . no danger of it ever coming off. With DUTCH BRAND you actually replace the tough rubber insulation originally removed.

This better Rubber Tape is made by an unusual formula which requires a high percentage of new, live rubber . . . using more new rubber than is found in ordinary tapes, adds longer life and a dielectric resistance of 20,000 volts through a single thickness.

DUTCH BRAND Rubber Tape is truly a modern product . . . good because it's made better. And what's also important, it costs you no more than less efficient insulation.

We shall be glad to send a test sample on request.

DUTCH BRAND *Rubber Tape, Friction Tape and Soldering Paste are sold by electrical jobbers everywhere.*

VAN CLEEF BROS. Established 1910

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DUTCH BRAND Rubber Insulating Tape

Fuses instantly without heat. Molds into one solid piece. It s-t-r-e-t-c-h-e-s without breaking because it contains more live, new rubber.

DUTCH BRAND Friction Tape
Standard Packages →

The Nos. 8, 4, 2 and 1 sizes are all available in the well known orange and blue individual and display cartons and metal counter dispensers for retail sale.

← The Jumbo Package

Contains 10 standard No. 8 rolls. The economical way for repairmen, electrical contractors and industrial users to purchase Friction Tape where individually cartoned tape is not required.

DUTCH BRAND *Rubber Insulating Tape*

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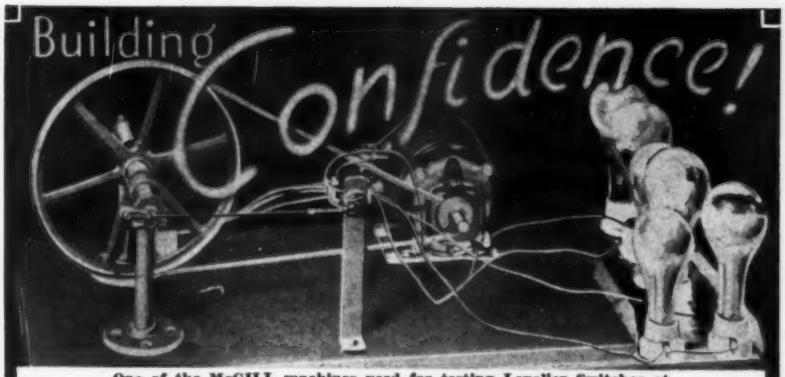

One of the McGILL machines used for testing Levolier Switches at more than 30 pulls per minute lighting six 100 watt lamps each time.

Users and makers of fractional horsepower motors, especially, like the way Levolier Switches hold up. No wonder: They are put to tests more severe than required by Underwriters' Laboratories. And every individual switch is tested cold, on full load, before it leaves the factory.

No. 41—Only ⅝-inch thick

McGILL *Levolier* SWITCHES

A few of the switches in the wide Levolier line include:

No. 41—Smallest 6-amp. switch for conduit boxes, canopies, fixtures, etc.

No. 39—Same, except with link for substituting for any link desired removed from original fixtures. Saves rewiring.

No. 1010—For controlling 1000-watt high intensity lamps.

No. 1039—Same, except with link.

No. 1020—10 amp. 2-circuit switch for 2-filament, 3-light lamps, up to 1250 watts.

No. 1029—Same, except with link.

McGILL MANUFACTURING CO.
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MORE BUSINESS
for Contractors . . . Better Jobs for Customers with
MULTI FLOODLIGHTS

No. 333-A OPEN TYPE FLOODLIGHT

More business is bound to come from featuring this Open Type Floodlight. It is ideal for intense lighting of near vertical areas such as walls of low buildings, or for distant illumination of ground areas such as ball parks, playgrounds, etc.

These units differ from the usual angle type reflector in that they are intended for high mounting and are constructed to divert the light downward. Furnished with different types of supporting brackets for mounting on wood or iron poles and walls. Get our catalog which gives complete details.

MULTI ELECTRIC MFG. COMPANY
1840 WEST 14th STREET.....CHICAGO, ILLINOIS

Questions on SIGNALLING and COMMUNICATION

[FROM PAGE 76]

nected to the feeder binding screw. The present section wire is connected to one of the section wire binding screws. The additional wire is then connected to the remaining section wire binding screw.

The revised wiring would be as follows: One side of the current supply is connected directly to the feeder binding screw in both annunciators. The other side of the current supply feeds one side of all push buttons. The button section wires connect to their respective lever binding screws on the new multiple type switch. The annunciator section wires are connected to the upper terminals of this multiple switch, one annunciator being connected to the odd numbered terminals, and the second annunciator being connected to the even numbered terminals. The levers when thrown in one direction operate one annunciator and when thrown in the opposite direction operate the second annunciator.

Rectifiers for Intercommunicating Telephones

Q. *An intercommunicating telephone system of the selective-ringing, common-talking type, at present operates from dry cells, one set being used for ringing, another set for talking. As it is necessary to replace these about twice a year, the expense of maintenance is rather large. We desire to eliminate this expense. Alternating current is available. What other source of current may be supplied to operate the system?*—T.J.

A. Would suggest the use of a dry plate type rectifier of the fully filtered type. This device, which is also known as a battery eliminator or telephone power supply cabinet, is being generally accepted for this class of work. It is "hum" free and does not interfere in any way with speech transmission.

Dry plate rectifiers furnish a low-voltage, approximately 6 volts direct current, for talking and 6-12-18 or 8-16-24 volts for ringing. They are designed for connection to the 110-125 volt a.c. circuits. The telephone system should be first checked to determine the proper voltages for talking and ringing. But the above voltages are standard for most systems of the type mentioned.

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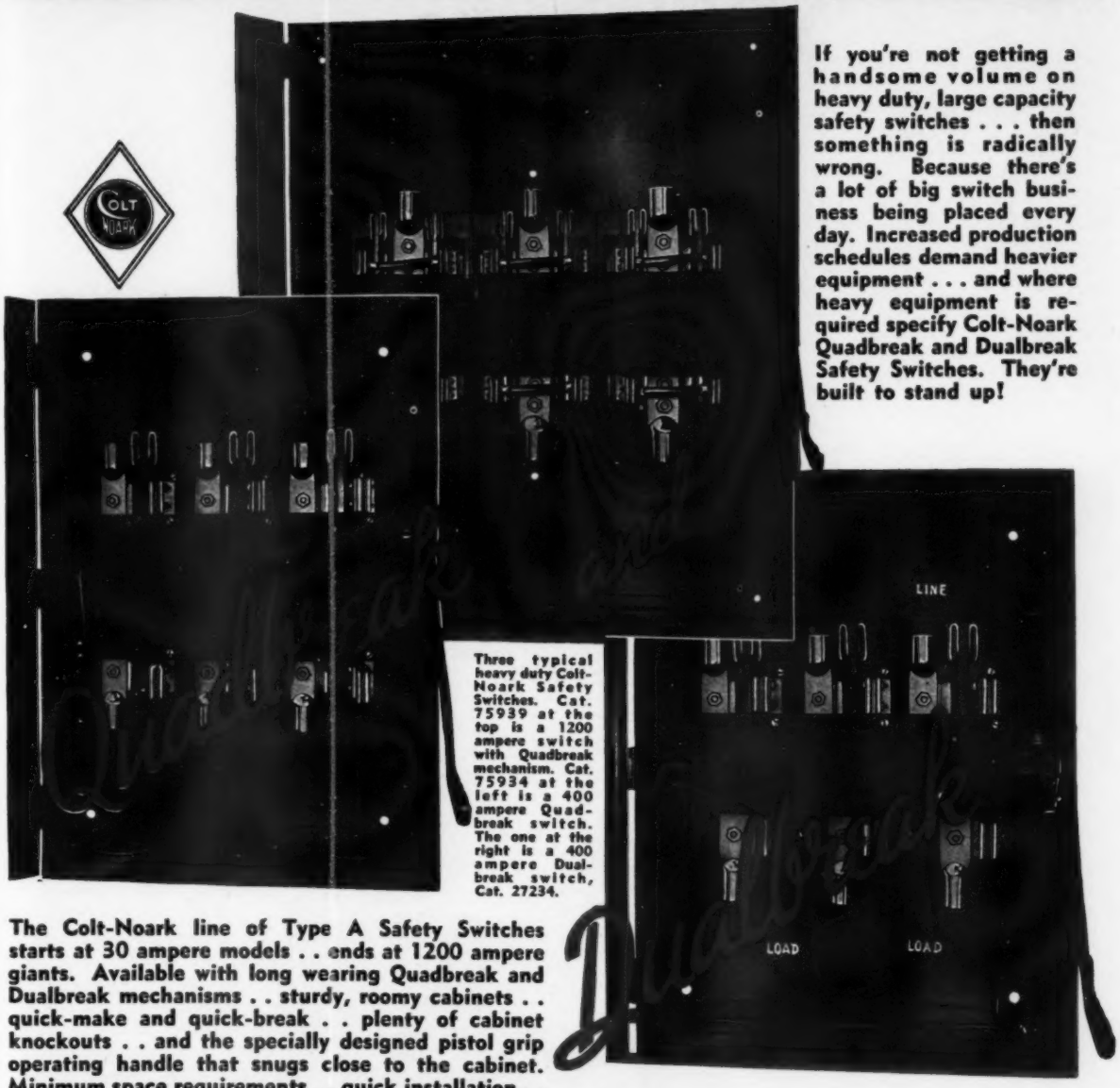
that mean bigger sales in big switches



Three typical heavy duty Colt-Noark Safety Switches. Cat. 75939 at the top is a 1200 ampere switch with Quadbreak mechanism. Cat. 75934 at the left is a 400 ampere Quadbreak switch. The one at the right is a 400 ampere Dualbreak switch, Cat. 27234.

If you're not getting a handsome volume on heavy duty, large capacity safety switches . . . then something is radically wrong. Because there's a lot of big switch business being placed every day. Increased production schedules demand heavier equipment . . . and where heavy equipment is required specify Colt-Noark Quadbreak and Dualbreak Safety Switches. They're built to stand up!

The Colt-Noark line of Type A Safety Switches starts at 30 ampere models . . ends at 1200 ampere giants. Available with long wearing Quadbreak and Dualbreak mechanisms . . sturdy, roomy cabinets . . quick-make and quick-break . . plenty of cabinet knockouts . . and the specially designed pistol grip operating handle that snugs close to the cabinet. Minimum space requirements . . quick installation . . safe operation! For bigger profits in big switches . . put in Quadbreak and Dualbreak Switches!

COLT'S PATENT FIRE ARMS MFG. CO.,
ELECTRICAL DIVISION
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Safety Switches up to 1200 Amperes

100 Years of Manufacturing Experience is back of every Colt Built Product

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High Lights IN THE NEWS

Motor Shop Men Plan Better Management

Management and selling were the chief topics of the motor shop convention just closed in Chicago. Despite the technicalities so vital in the motor shop industry, business problems received generous treatment. Delegates from shops located in 29 states were represented at this meeting, topped off of course by a heavy turnout among the Chicago group. There is a local shop organization of 50 members. The prevailing opinion was that this convention of the National Industrial Service Association, at the Hotel Stevens, April 19 to 21, was their most fruitful meeting.

Addresses on intimate industry topics were presented by specialists on product and equipment design. Papers by N.I.S.A. members covered such topics as: local group management, dimensional basis of determining winding costs, cost accounting and overhead, annual survey of winding prices, cost of operating a plant shop, engineers in the shop, small motor repairs, employee wages and bonuses, listing used equipment, selling new equipment and the value of the service shop to electrical manufacturers.

One of the most interesting contributions, among the members' papers came from Geo. P. Svendsen, Minneapolis on "Winding Costs Based on Physical Dimensions." He offered a new approach to the pricing of re-wind work based on the "DZL" method of computation, by developing winding costs upon the relative physical proportions, regardless of speed or power rating. This paper, accompanied by a comprehensive chart, revealed the greatly simplified procedure now possible. Heretofore winding schedules have entailed a multitude of makes and speeds. According to Mr. Svendsen's investigation, many different makes and types of motors now fall into one of a limited series of DZL dimensions under his plan.

John E. Launder presented tentative qualifications for eligibility to the certified repair plan, embracing standards of: (1) integrity, (2) experience, (a) three years as a shop proprietor, (b) three years experience by all heads of shop departments, (3) responsibility of members in engineering, (4) reasonably adequate equipment. He explained that the plan would include also fixed guarantees by members.

From the product and equipment specialists came new facts about motor, controller, insulation and shop equipment developments. From the trade press A. G. Carson, associate editor of *Electrical Manufacturing*, and Frank J. Seiler, associate editor of *Electrical Contracting* spoke. Mr. Carson presented views regarding standards under a plan of shop certification, while Mr. Seiler reviewed trends under the topic "Shops of the Future."

Other member papers and discussions were enthusiastically received, especially a humorous, but thorough exposition of service shop selling and advertising responsibilities by Arthur Wagner of Chicago. A period of open discussion followed each paper. Copies of nearly all papers were available during the sessions.

Plans for the coming year include authorization of the executive committee to work out a Certified Repair Plan to take such action as it sees fit toward engaging an executive manager of the association, either on full or part time. An amendment to the constitution and by-laws now provides for the addition of associate members to the association, by invitation on the part of the executive committee. Another amendment gives firms, operating shops in two or more cities, one vote only.

In opening this year's meeting, president E. C. W. Johnson of Indianapolis reviewed the chief objectives of the past year as: dissemination of further overhead and cost data and methods of keeping office records, development of price standards, stabilization of discounts on rebuilt equipment, improvement of trade relations and price differentials, and consideration of possible coalition or coordination of interests with N.E.C.A. motor shop section. Many of these matters were covered by various members' addresses.

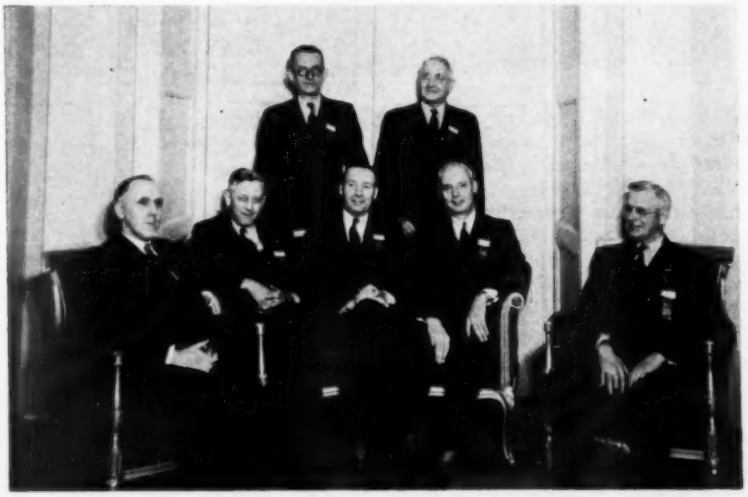
Mr. Johnson stressed the association's healthy growth, which has brought a steady increase in important staff duties. The time has come to take steps toward obtaining an executive manager. Vice-president Wm. J. Wheeler reported on the type of new members acquired during the year as an indication of N.I.S.A. progress, and cited 35 service bulletins sent to members during the past year on shop matters.

Officers for the coming year were elected at the Tuesday session. They are: president, Wm. J. Wheeler, New York; vice-president, John E. Launder, Kansas City; secretary, C. A. Sievert, Chicago; treasurer, Alfred L. Brown, Worcester (Mass.); and, E. C. W. Johnson, Indianapolis, W. W. Hanks, Charlotte, (N. C.), H. H. Roessle, Pittsburgh, A. F. Anderson, Nashville, and F. M. Mielke, Duluth, executive committeemen.

The Chicago convention committee was headed by C. A. Sievert, whose able assistants planned a fine entertainment program. There was a busy schedule for the 30 ladies present.

ROCKY MOUNTAIN GROUPS COMBINE

Denver has launched a big cooperative program that will promote the electrical market in six states. The Rocky Mountain



NEW OFFICERS—Front row (left to right), C. A. Sievert, secretary, W. W. Hanks, first president (now exec. committeeman), Wm. J. Wheeler, president-elect, E. C. W. Johnson, retiring president and executive committeeman, Alfred L. Brown, treasurer. Back row, John E. Launder, vice-president, F. M. Mielke, executive committeeman.

P&S

Announces NEW PROCESS METAL Wall Plates

In the new P&S "X" plates you have a set-up that tops anything the whole industry has to offer—new beauty—new durability—and new popular prices.

These plates are metal—with a multiple coat of baked-on insulating enamel—giving all of the style and zip of bakelite—with none of the usual disadvantages—they will not warp, crack, or curl—truly a royal family of wall plates that sparkle with sales appeal and add new profits.

PASS & SEYMOUR inc.

Syracuse, N. Y.

PASS & SEYMOUR, INC.
Syracuse, N. Y.
Send me catalog information on the new "X" plates.
NAME
ADDRESS

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High Lights IN THE NEWS

[FROM PAGE 80]

Electrical Association and the Electrical League of Colorado have been consolidated. This matrimony was celebrated, in Denver, at a big party on April 5, at which prominent electrical men from all that area were present, including many contractors.

The new organization will be known as the Rocky Mountain Electrical League. While its geographic boundaries are confined to Colorado, New Mexico and Wyoming, it extends its services also to various affiliated communities in South Dakota, Montana and Nebraska.

The Rocky Mountain Electrical League, as the new association will be known, will establish local chapters, throughout its territory. A number of these are already in the formative stage. The Denver League is now functioning. It will help finance all local Leagues for sales promotion activities, through support from manufacturers, distributors and others. A big tri-state electrical jubilee is planned for the Autumn to culminate in a series of expositions and shows throughout the Mountain area.

The League will participate in national promotional conferences and pursue a thirteen-point program of its own. A wide distribution of the new "Handbook of Interior Wiring Design" is planned.

Guy W. Faller of the Public Service Company of Colorado, Denver, is president. There will be five major divisions of the Rocky Mountain Electrical League—grouping retailers, contractors, wholesalers, manufacturers and utilities. R. Y. Chedister, of Denver, will direct the activities of the contractors divisions.

NIAGARA FRONTIER ELECTS OFFICERS

New officers have been elected to serve the Niagara Frontier Electrical Contractors Association in Buffalo. They are George Reinagel, president, Otto Wangler, vice president, Peter Quermback, secretary and Frank Schumm, treasurer. To draw out a crowd for the election a "Variety Night" smoker was staged at a local dance hall and the contractors turned out, well supported by their loving and welcome friends the wholesalers and manufacturers salesmen.

SHOT GUN WEDDING—The nuptials of the Rocky Mountain Electrical Association and the Electrical League of Colorado were solemnized in Denver with a dinner, wedding cake and gifts. Guy W. Faller, the president of the new Rocky Mountain Electrical League, is receiving a shot gun from Gaylord B. Buck, former head of the Colorado league. There was a big turn out—and lots of enthusalum, as Caeser used to say

R.E.A. CO-OP ALLOTMENTS

Rural Electrification Administration announces, as of April 7th, the following allotments of money for the construction of rural lines:

1. New York, Sussex County—$42,000 to a cooperative to be organized to build 35 miles, to serve 200 customers.
2. North Dakota, Cass County—$185,000 to Southern Cass County Cooperative of Kindred, to build 154 miles, to serve 480 customers.
3. Wyoming, Goshen County—$33,000 to Wyrulee Company of Lingle, to build 29 miles, to serve 85 customers.
4. Iowa, Scott County—$100,000 to Eastern Iowa Light & Power Cooperative of Davenport, for 105 miles to serve 245 customers in seven counties.
5. Montana, Richland County—$115,000 to Lower Yellowstone Rural Electrification Association of Sidney, to build 110 miles to serve 328 customers, in three counties.
6. Minnesota, Wright County—$154,000 to Wright-Hennepin Cooperative Electric Association of Cokato, to build 159 miles to serve 469 customers, in two counties.
7. Minnesota, Nobles County—$230,000 to the Nobles Cooperative Electric Association of Worthington, to build 230 miles to serve 592 customers in seven counties.
8. Nebraska, Adams County—$475,000 to the Southern Nebraska Rural Public Power District of Hastings, to build 435 miles to serve 1825 customers, in three counties.
9. South Dakota, Union County—$105,000 to the Union County Rural Power Company of Elk Point, to build 107 miles to serve 300 customers, in Union County.
10. Wisconsin, Pierce County—$330,000 to the Pierce-Pepin Electric Cooperative of Ellsworth, to build 333 miles to serve 982 customers, in two counties.

COOPERATIVE PUBLICITY

Leagues and power companies in many communities carry on commendable publicity work to show the public what is happening in the way of electrical modernization. In Dallas, Tex. the local electrical contractors receive prominent mention for the part they play in wiring for interesting lighting or power applications.

A monthly publication, "Your Electric Ally," which is gotten out by the Dallas Power & Light Company, usually consists of eight pages of choice illustrations of recent local jobs, all carefully explained. Beside various photos are ruled "boxes" giving the name of the electrical contractor and the architect.

NEMA STANDARDS

The National Electrical Manufacturers Association announces three new standards—

1. NEMA Attachment Plug Standards, Pub. No. 36-40, concerns the manufacture and test of attachment plug caps, bodies and

FLOODLIGHT OF THE MONTH

No. 3 of a series to acquaint you with G-E floodlights—to help you increase profits.

General-utility Floodlight Type AL-48, 1500 watt

HERE ARE ITS USES

First choice for most sports-field lighting is this comparatively new-design floodlight. It is applicable as well to any medium or large-size construction area, storage yard, or parking field. Its efficiency compares favorably with that of the most expensive high-wattage floodlights, but its simplified design permits attractive low prices—important contributions to economical area lighting.

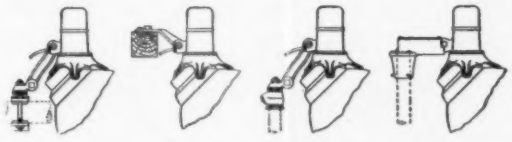
Suggested applications and lighting recommendations are contained in a complete floodlighting catalog and in our sports-lighting layouts—available at the nearest General Electric office or branch of the General Electric Supply Corporation. For further assistance, trained lighting specialists are at your service.

HERE'S HOW IT PERFORMS

Lamp	Reflector	Beam Angle	Beam Lumens
Clear	Polished	29°	13,350
Inside-frosted	Polished	55°	14,550
Clear	Etched	85°	16,700
Inside-frosted	Etched	90°	16,000

(Approximate data for floodlight with plain clear door glass. Open type produces approximately 10 per cent more beam lumens)

HERE'S HOW YOU MOUNT IT



Pipe Clamp | Crossarm | Pipe top | Slip fitter

HERE'S HOW IT'S MADE

Reflector—Spun Alzak Aluminum, the new high-efficiency, long-lasting reflector material. Surface either polished or etched.

Support and cover—Cast-aluminum alloy, attached with cadmium-plated brass screws.

Socket—Mogul, porcelain base, positioned for 9½-in. light-center General Service lamp.

Mounting—Cast aluminum or galvanized malleable iron, as shown. Four feet of insulated cable included with each unit.

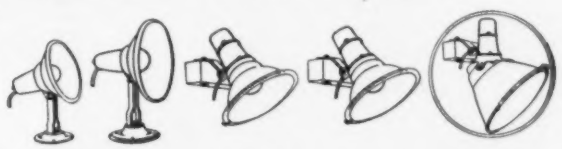
Door—Clear heat-resisting glass assembled in new slide-type ring with handle, suspension chain, and locking clamp.

HERE ARE ITS PRICES

Open-type floodlight, with etched reflector..... $25.00
with polished reflector..... 32.00
Enclosed-type, with clear glass and retaining ring add..... 15.00

All above include crossarm bracket mounting.
For pipe-top or pipe-clamp mounting, add $1.00; for slip fitter, add $2.00.
All prices list, including freight charges.
Prices and specifications subject to change without notice.

HERE'S ITS PLACE IN THE LINE-UP



Type AL-35 100-watt | Type AL-36 200-watt | Type AL-49 300/500-watt | Type AL-43 750/1000-watt | Type AL-48 1500-watt

500-222

GENERAL ELECTRIC

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FOR TIME-SAVING PROFIT-MAKERS

USE LATROBE

No. 130 "LATROBE" ADJUSTABLE WATER-TIGHT FLOOR BOX

No. 130 Box with No. 207 Bell Nozzle. Cut-away view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Design eliminates many small parts. Cover plate 3½"—overall height 3½".

No. 110 "LATROBE" WATERTIGHT BOX

Cut-away view of No. 110 Box showing how the tapered unit receptacle fits tapered opening in top of box body. The last word in design, appearance, and simplicity of installation.

FLOOR BOXES AND WIRING SPECIALTIES

● The simple and sturdy trouble-free construction of Latrobe Products offers contractors the opportunity to save money on installation costs . . . with full assurance of dependable performance. Examine these features yourself. On your next job use Latrobe floor boxes and wiring specialties.

Write for Catalog

▼

FULLMAN MANUFACTURING COMPANY

LATROBE PENNA.

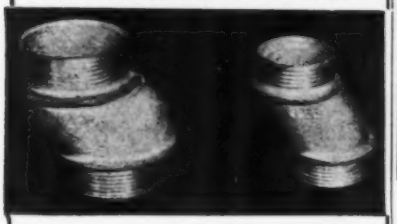
No. 284 DUPLEX RECEPTACLE NOZZLE

With ½" brass pipe extension. Neatest and most compact fitting obtainable. Also available with ¾" pipe extension. Fullman also offers Duplex Telephone Nozzles.

No. 285 DOUBLE DUPLEX RECEPTACLE NOZZLE

The most attractive, compact and easy-to-install fitting on the market. Shown in illustration with No. 200 Cover Plate.

The Hartman Line



An offset nipple* which permits mounting of switches, gutter outlet boxes and other equipment where knockouts don't line up.

*Patent applied for.

WEATHER PROOF SOCKET

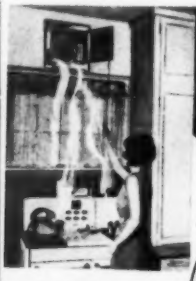
Made of aluminum alloy with a high polish finish. Built to hold heavy reflectors at any angle. Neat in appearance — easy to install.

For information see your jobber or write direct.

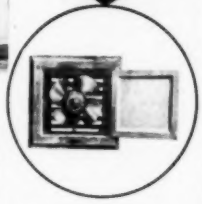
B. HARTMAN

168 Sunset Street

LONG BEACH, CALIF.



Built-in KITCHEN Vent Fan FOR OLD OR NEW HOUSES



AUTOMATIC . . . EASY TO INSTALL . . . ADJUSTABLE to wall thickness . . . no wood nor metal frame necessary . . . no screws in plaster, wood or brick needed to install.

The 10-inch quiet type fan removes cooking odors, steam, smoke and excessive heat quickly and quietly—a vent fan in demand. Available for A. C. or D. C. current; A. C. type is non-radio interfering. Automatic switch and shutters are controlled by opening and closing of the door. Opening the door starts the motor and opens the shutters. Closing the door stops the motor and closes the shutters. Attractive finish—inside and outside frames are polished cast aluminum, adjustable for wall thickness 7" to 13"—special for walls 12" to 24" at small additional cost. We'll gladly send you complete information upon request.

SIGNAL ELECTRIC MFG. CO.

Menominee, Michigan

Offices in all principal cities

SIGNAL

High Lights IN THE NEWS

[FROM PAGE 82]

receptacles, including dimensional standards for the 2, 3 and 4 pole caps and receptacles.

2. NEMA Oil Circuit Breaker Standards, Pub. No. 36-38.

3. NEMA Power Switchboard Standards, Pub. No. 37-39.

Copies of the publications may be obtained from the National Electrical Manufacturers Association, 155 East 44th Street, New York.

FOR FORTY YEARS—Congratulations are coming to the Maintenance Company of New York. William J. Wheeler, president, is celebrating their forty years of service to the electrical equipment of Manhattan buildings, and proud of the record of his firm. The company was originally formed to service elevator motors and controllers. Since that time facilities have been added to take care of all types of mechanical and electrical repairs to modern building equipment. They are now starting on another forty years with bright prospects.

INDUSTRIAL WIRING DATA

A new 502-page revision of the book "Industrial Electricity and Wiring" will be of interest to the student or practical worker. It begins with fundamental theory and continues with eighteen chapters covering various important phases of electrical construction problems. Now in its second edition, the text is written to conform with latest N.E.C. and National Electrical Safety Code requirements.

Each chapter takes up one part of the everyday wiring system, to more or less include the principal chapters of the National Electrical Code. In addition there are 34 pages with diagrams and tables in Chapter 3, on how to make calculations for wiring systems. A chapter covering

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LOSS BY FIRE
Is an Insurable Risk

Instruments detect Losses
THAT COME OUT OF INDUSTRY'S POCKET

Over $250,000,000. That is what fire cost this country during 1935. But little if any of this loss came out of an individual manufacturer's pocket. Wise management recognizes the value of insurance and guards against the Demon FIRE.

Electrical losses, however, are biting huge chunks out of Industry's profits day in and day out. A lathe machinist, by taking too big a bite with his cutting tool, may be overloading the drive motor. A 15-Hp. motor may be doing a job that a 5-Hp. one could do easily. Both are profit leaks, small individually, but huge in the aggregate.

And worst of all, these profit leaks may go on forever . . . *unless they are detected by instruments.*

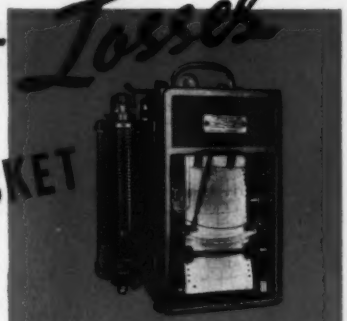
There is only one efficient and economical load for any electrical device, and that is its name-plate rating. And there is only one reliable means of determining load conditions . . . *the consistent use of electrical instruments.*

But even the intelligent use of electrical instruments is not enough unless the instruments have the quality that assures economy. Make sure your test data has the maintained accuracy secured with Westinghouse Portable Instruments. J 40089

• • •

Westinghouse portable instruments have the accuracy, durability, and ease of reading which have marked Westinghouse instrument manufacturing since 1888. Available in every standard size and rating, these instruments are reasonably priced. No logical reason exists for accepting lower quality.

ASK for Booklet 2090, WESTINGHOUSE PORTABLE INSTRUMENTS
Room 5-N, East Pittsburgh, Penna.



Type U Recording Voltmeter.

Type FY-5 Double-Range Voltmeter.

Type FY-4 Five-Range Voltmeter.

INDUSTRIAL ANALYZER—Self-contained for making complete a-c. tests up to 125 amperes, 600 volts on single-, two-, or three-phase circuits.

Westinghouse
PORTABLE INSTRUMENTS

SINCE 1888
METERS INSTRUMENTS RELAYS

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There's Profit for You In These Savings with Air-cooled Transformers

LOOK over these ways in which your customers can save with G-E air-cooled transformers. There's a quick, easy profit for you in selling a product that will save your customers money or will improve their plant efficiency. Progressive plant managers welcome information of the type you can bring them about G-E air-cooled transformers. Ask for complete details, and cash in on this profitable business. General Electric, Schenectady, N. Y.

General Electric Company, Department, 6—201 Schenectady, N. Y.

Please send me a copy of your Bulletin GEA-897F, "Air-cooled Transformers for Lighting and Power Service."

Name .....

Company .....

Address .....

330-87

GENERAL ELECTRIC

UMI

High Lights IN THE NEWS

[FROM PAGE 84]

estimating for industrial and house wiring occupies ten pages. Arranged for use as a textbook, each chapter is concluded with a set of numbered review questions.

"Industrial Electricity and Wiring" (Second Edition), James A Moyer and John F. Wostrel, $2.75, 502 pages, 6x9, cloth-bound, McGraw-Hill Book Co., Inc.

KITCHEN MODERNIZATION PROGRAM

The National Kitchen Modernization Bureau of 420 Lexington Avenue, New York, has issued an attractive 24-page pamphlet, outlining the activity planned for 1937. Advertising helps, customer sales aids and window displays are listed.

There will be an extensive publicity program and a nationwide modernization contest, with prizes totaling $3,000,000, it is stated. Successful operations in a number of communities are described to assist in planning local programs.

THIS CO-OP. TALKS SENSE

Dear Editor: I wish to contradict one of your editorials published in the January issue of Electrical Contracting, namely "Rural Wiring Gone Wrong."

The Federated Electric Cooperative is a central organization set up by its numerous member associations to do engineering, auditing and legal work for R.E.A. cooperatives. We are aware that there has been a lot of misinformation given out as to the cost of electric wiring but we have done much to give the people better information.

We have but one project actually under construction at the present time, but we have others that have their allotment from Washington. In this project we have induced the board of directors to adopt the National Electric Code and enforce an inspection. This, of course, means that persons not having some electrical training and knowledge of the code, cannot engage in wiring.

We have also published a wiring guide for the electrical contractor and one for the farmer. The farmer's guide gives him some very good information on wiring. In the contractor's guide, we have attempted to help him follow the code by telling him where he can find some of the more important articles in his code, pertaining to rural wiring. We have not attempted to interpret the code for him, but we have set down some of the rules.

We have gone further than that. We have conducted a number of experimental wiring jobs to be able to have actual and basic figures on the cost of wiring. This information we are passing on to other cooperatives. We have conducted a school at the offices of the Federated Electric Cooperative during the week of January 25 to 30 to give the local electric associations all the information we have along the lines of engineering, wiring, inspection, legal and the many other phases of the rural electrification program.

We want it understood that we have not endorsed cheap wiring jobs, and we have pulled for the qualified contractor. We have gathered some very good information from reliable sources as far as wiring is concerned and we are willing to work with any person or persons who are cooperatively minded. Now after seeing what we have done and what we are trying to do, do you think we are still worthy of the rude phrase "silver tongued apostles?"

FEDERATED ELECTRIC COOPERATIVE
By: C. L. Palmerston

—Of course we don't!

***PENNSYLVANIA TRIPPERS**—For years members of the Electrical Contractors Association of Lancaster, Pa., have ganged up and made excursions to various points of electrical interest. Here we see them posed while inspecting the works of Crescent Insulated Wire and Cable Company, at Trenton, N. J. Credit for this fine piece of cooperative educational work is largely due George N. Richardson, veteran contractor and proprietor of the Lancaster Electric and Construction Company. George not only rounds up contractors for these trips, but also signs custody papers for wholesalers, inspectors, power company employees, plant engineers and school instructors released from desks, slipsticks and sales manuals.*

If you want to get ahead in this game, remember this — you can't do a good job with poor tools. It pays to buy the best.

The Kraeuter Line has been the favorite of experienced electricians for the past 70 years. And these tools will help YOU turn out better work with less time and trouble. For full information write: Kraeuter & Company, Dept. "C".

No. 4601—ELECTRICIANS' DIAGONAL CUTTING PLIERS made especially for close cutting. Forged from special plier steel and precisely fitted for exact work. Sizes 4½" to 7½".

No. 1661—NEEDLE NOSE SIDE CUTTING PLIERS. A fine slender nosed, tapered point plier, a standard tool for most types of electrical work. 6" only.

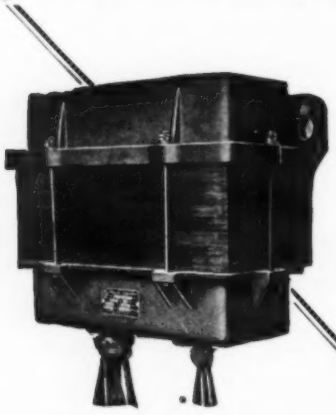
No. 1831—ELECTRICIANS' HEAVY DUTY PLIERS. Just the thing for general wiring work. Strongly constructed with sturdy wire cutters. 4" to 8" sizes.

No. 1781—EXTRA LONG NOSED PLIERS. Indispensable for use in "tight spots" where the work is hard to reach. Has side cutter. 7"only.

KRAEUTER & CO.
(Pronounced KROY-TER)
NEWARK, N. J.

Manufacturers of Highest Quality Pliers and Tools Since 1860

If you use TRANSFORMERS *you will be interested in latestdevelopments by* AMERTRAN

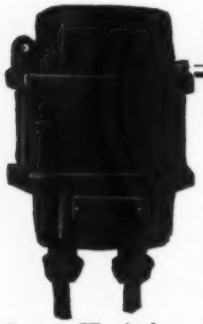


Type CFT three-phase, outdoor-type, air-cooled transformer

Types CF and CFT

- Air-cooled—no oil nor fireproof vault.
- Conduit Fittings—easy to install.
- Single-Phase or Three-Phase types.

AmerTran Air-Cooled Transformers and Auto-Transformers reduce operating costs . . . they may be used on single- or three-phase circuits for supplying 115/230 volts for lighting or power from 230-, 460-, 575-, or 2300-volt power circuits so that advantage may be taken of the lower power rates. Other standard types are furnished for phase-changing, voltage boosting and operating low-voltage equipment. AmerTran is also prepared to furnish many other types of transformers, including types for distribution, power, testing, welding, etc. May we have the opportunity to send information on equipment to meet your requirements?



Type CF single-phase, outdoor-type, air-cooled transformer

AMER TRAN

American Transformer Company
160 Emmet Street
Newark, N. J.

More GOSSIP

Be Careful

Shopmen who plan to undertake refrigerator motor work must be careful about entering into flat contract propositions. In some localities there are flocks of motors at an attained age which makes for high general repairs on them, says Paul W. Curtis, Curtis Electric Co., Chattanooga, Tenn.

Permanent Records

Strange motor rewinds are diagrammed on the back of the shop ticket and later done neatly on alphabetical data sheets for permanent reference, by H. S. Hughes of the Electric Service Co., Cumberland, Md.

CANADIAN SPECIALIST — For 32 years George T. Dale has been doing things to motors, controllers and other industrial equipment in and around Toronto, Ont. But when the candid camera clicked, this NECA member was not laboring with income tax returns. He was checking up on the possibilities of some new shop equipment for his Electrical Maintenance and Repairs Company, Ltd.

Line Production

Looking ahead to greater mechanization of fractional horsepower production, the Refrigeration Motors Corp. of Long Island City, N. Y., has arranged its benches for the future installation of production line conveyors.

Locks Standardized

There is no fussing around with 57 varieties of keys at the Reserve Electric Co. in Cleveland. Master keys work the locks on all tool boxes, the company's garage, parts cabinets and men's locker rooms.

ELL-STRIP
WIRING CHANNEL

means ***SIMPLICITY AND COMPLETENESS***

FOR ALL TYPES OF WINDOW LIGHTING COVE LIGHTING LUMILINE LIGHTING

Write for our NEW COMPLETE CATALOG just off the press showing applications of *STANDARD ANGLE SOCKETS STRAIGHT LINE LUMILINE MOUNTING* and many other details.

SOLD THROUGH WHOLESALERS

ELLICOTT MFG. CO.
413 So. Clinton St., Chicago, Ill.

K&H
Solderless Terminal
LUGS
and Connectors

DUPLEX LUGS

Round or square end—one or two attaching holes . . . .

Capable of receiving two conductors of same size or of different size. Also made to hold more than two conductors. Wire size up to two million C. M. The larger sizes have two or more binding bolts and insure vibration proof contact.

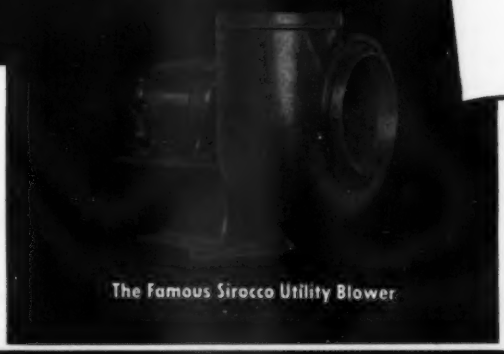
A connector for any job

WRITE FOR COMPLETE CATALOG

KRUEGER & HUDEPOHL
232-8 Vine Street, Cincinnati, Ohio

"American Blower Sales Plans Help *Us* MAKE MONEY," Electrical Contractors Say

The new Ventura Ventilating Fan



The Famous Sirocco Utility Blower

Send for *FREE COPY* of our 1937 SALES PLANS for Ventilating Contractors and Electrical Dealers

The American Blower line of electric ventilating equipment is the most complete in the industry. It is backed by years of experience and time proved in many thousands of installations of every type and description. It is sold nationally and supported by an extensive advertising program running in national magazines, trade journals, business publications, etc., in addition to a widespread direct mail advertising campaign to consumers. Write today for your copy of our new compact sales plan — tells you where and how to sell electric ventilation and how to tie in with our great national advertising activity.

AMERICAN BLOWER

Division of American Radiator and Standard Sanitary Corporation

6000 RUSSELL STREET · DETROIT, MICHIGAN

AMERICAN BLOWER CORPORATION
6000 Russell St., Detroit, Mich.

Gentlemen:
Please send copy of your 1937 sales plans to:

Name _____

Street and Number _____

City _____ *State* _____

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Don't miss the valuable June Issue of

ELECTRICAL CONTRACTING

with an Editorial feature section

"TOOLS ON THE JOB"

containing

1. Tooling to cut costs
2. Tool economies on conduit work
3. Handling EMT, fibre, underfloor
4. When you pull wire and cable
5. Special tools for odd jobs
6. Who makes tools

Also in June

"THE MID-TUNNEL JOB"

Wiring and equipment in the 38th St. Tunnel under the Hudson River. A spectacular engineering feat.

"NEW LIGHTING FOR STORES"

"ELECTRONIC CONTROL"

—and many other features

MANUFACTURERS

Tell the story of YOUR products in this valuable issue. Final closing date for advertising, May 19th.

ELECTRICAL CONTRACTING • 330 WEST 42nd ST., N. Y. C.

More GOSSIP

Good Sweating

Ferguson Electric Construction Co. recently sweated bare copper tubing and fittings while installing three 1,000 k.v.a. transformers in remodelling a plant in Buffalo. The crew did such a good job that they are now being consulted by local plumbers, who have had trouble getting tight joints on their copper lines and threadless fittings.

John Kuhlemeyer

John Kuhlemeyer, a veteran of industry organization, of "add a profit" fame, was guest at the recent annual dinner of the Youngstown, Ohio, contractors. And John got a kick out of coming down there from Chicago. Looks like the good old days are back.

PUT TO WORK—You can't keep a good car down any more than a good man. This is what Harry H. Walker, Los Angeles electrical contractor, felt about his family Packard sedan. The dealer offered so little as a trade-in that Walker decided to convert the faithful chariot into a truck. The truck has seen hard service in the construction of transmission lines across the desert, where Walker is now installing giant pumps to lift the Colorado River water over the Sierras for distribution to Southern California.

Hot Alligators

Cold weather descended upon the Brookfield Zoo in Chicago. The alligators and turtles looked sad and uncomfortable. They would not eat. They barely moved about and avoided the sand in the reptile house. What to do?

Zoo Director Edward Bean took the situation in at a glance and rushed to the rescue with 600 feet of General Electric soil heating cable, placed in the sand. Now with their feet warm, the reptiles are cheerful and ready for any weather.

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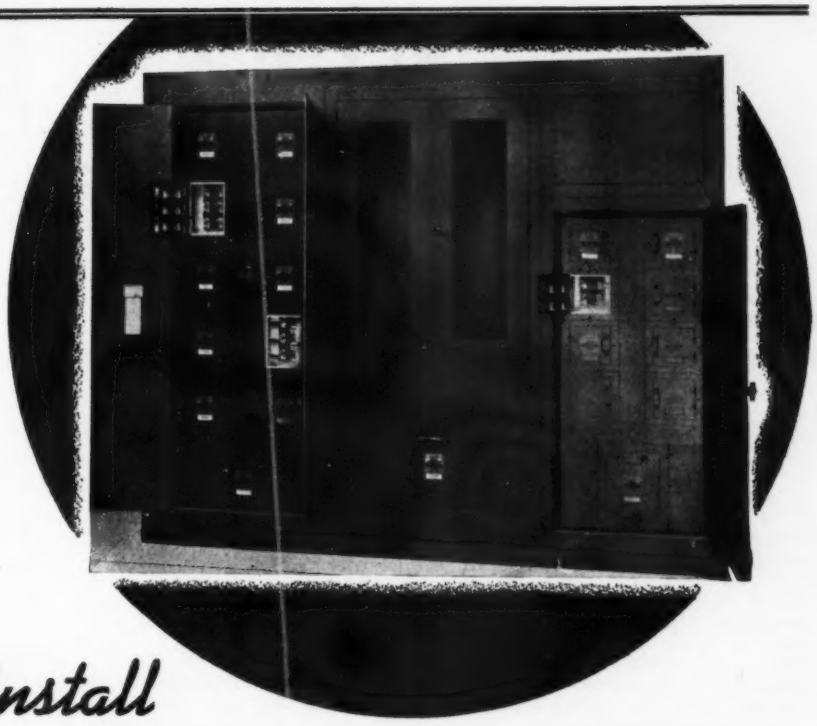
FA Panelboards . . .

"THE SIGN OF A BETTER JOB"



Install MORE SERVICE EQUIPMENT on NEW AIR-CONDITIONING JOBS

LOOK for new Air-Conditioning jobs that are being installed in Hotels, Restaurants, Hospitals, Stores and other public buildings in your territory — and you will find many opportunities for putting in new FA Service Equipment which is frequently necessary to carry the added load . . . This is the time to take advantage of a situation that is all in your favor . . . It's a "natural."

Remember Frank Adam is in business to help your business. We specialize in Service Equipments for large capacities where we include in one compact assembly, not only the main service switch, but the current transformer for the meter, large capacity feeder branches, as well as light and appliance branch panelboards.

Dependable quotations, on time—Deliveries made when material is required on the job—Standard unit construction that always assures an accurate fit of all component parts.

Send for this New Catalog

The New FA Catalog No. 56 is especially valuable because it contains necessary engineering reference and pricing data, intelligently arranged to enable you to easily figure correct prices on all types of standardized panelboards . . . Send for copy.

Frank Adam ELECTRIC COMPANY
ST. LOUIS

UMI

News of NECA

CALIFORNIA GROUP TACKLES MANY PROBLEMS

Taxation reared its hungry head, regulation issued its warning to the "carpetbagger", collusion of manufacturers was decried and labor costs and selling prices were scrutinized, at the semi-annual meeting of the Electrical Contractors Association of Northern California. The meeting was held in Fresno, Calif., April 10. Frank Boyd, Pacific Electric Motor Co., Oakland, frankly presented the problem of the increase in National dues and the matter was placed in the hands of the executive committee for action, which will decide the charter status of this association.

Richard Lazarus, attorney and manager of Fresno's Better Business Bureau outlined the advantages and disadvantages of corporation or partnership as a basis for taxation. Dan Bronson, California Electric Works, Oakland, analyzed the "cease and desist" orders of the Federal Trade Commission issued to electrical manufacturers.

Roy Butcher, San Jose electrical contractor and chairman of the California State Contractors License Board, told of proposed amendments to the Contractors License Law which would remove agricultural exemptions, reduce the small work exemption to $50, and empower the board to set up some form of pre-qualification for licensees. After discussion of labor costs, led by Louis Donat, Buzzell Electric Works, San Francisco, a committee was appointed to make a study of the actual costs, overhead and profit, involved in the sale of labor.

He enunciated the board's policy that it would seek to make the construction industry profitable on the grounds that it is in the public interest; that the contractor who does not get a true cost and reasonable profit is in effect creating a condition which denies to other contractors their constitutional right to earn a living by fair means.

Laurence Davis, bearing regrets from Earl Peak at his inability to be present, outlined the program of NECA, told of progress made in the Industry Coordination and Promotion Program, outlined the trends in business which make a national association as necessary as a local one, and reviewed what benefits other associations have derived from the voluntary code, and the new respect which the Peak program had created for contractors in the industry.

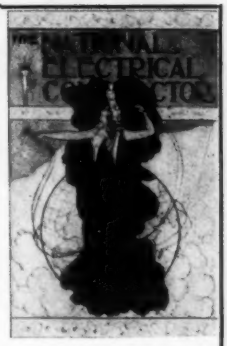
A. L. Stone, Stone Electric Supply Co., Los Angeles, and national executive committeeman for the Pacific division, told of plans being made to entertain the national convention in Los Angeles, Oct. 18-21. Tours of the movie colony, a trip to Catalina, visits to Boulder Dam and other outstanding features are contemplated.

DAVIS TOURS THE COAST

Pinch hitting for President Earl Peak, who after all must be expected to devote a little time to his business, Laurence W. Davis, general manager of the National

CHAMBLINS — CLYDE AND GARTH—Clyde L. Chamblin, former president of NECA and the old war horse of the west, now has two sons in business with him in his California Electrical Construction Company in San Francisco. Here he is with Garth in a new lighting demonstration room set up at the rear of the store. The walls are in three tones of green and a Venetian blind shuts it off when a demonstration is on. All customers and prospects are taken in there and it has helped close several good lighting jobs.

35 YEARS AGO



TIME cards which provide a breakdown of labor costs under sixteen classifications of work are reproduced with checking charts for recording starting and finishing times during forenoon, afternoon and overtime periods.

An average man is said to bore sixty ¾-in. holes per hour in 2-in. hemlock joist, but can bore 120 with extra exertion.

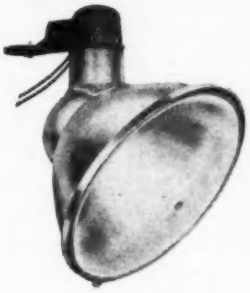
Remember "Renim" cast-iron universal switch boxes with their extruded fastening lugs? Points of superiority in an ad claim a saving of over one foot of conduit on each box.

Baltimore's new electrical inspection ordinance, just approved, provides for two inspectors at $2500 and $1500 "per annum."

"A Common Trouble" by W. S. R., cites the rejection of several bids for a large isolated plant installation after a member of the National Supply Dealers' Association offered to furnish the owner all materials, and a competent engineer at $5 per day.

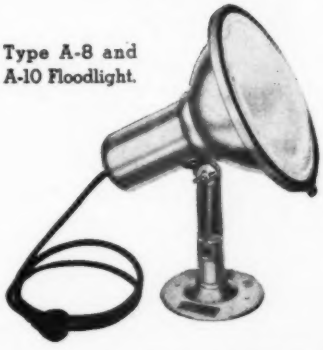
NEW ENCLOSED TYPE FLOODLIGHTS

INEXPENSIVE AND EFFICIENT FOR UNIVERSAL APPLICATION



Type AV-16 and AV-20 Floodlight.

Type A-14, A-16 and A-20 Floodlight.



Type A-8 and A-10 Floodlight.

All the advantages of *enclosed type* floodlights are now available for universal application . . . *at low cost!*

Efficiency and construction features formerly found only in the most expensive equipment, are provided in the new Westinghouse "A" Line floods. Type A units are offered in 8, 10, 14, 16 and 20-inch sizes, and Type AV, for vertical burning lamps, in 16 and 20-inch sizes.

Both Types A and AV are constructed with reflectors finished by the Alzak process . . . a patented finish that offers higher efficiencies and can be easily maintained at maximum efficiency. And there are a host of other selling features and practical service values for any general floodlighting use.

Get all the interesting facts from your nearest Westinghouse Jobber . . . or write direct to Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

TYPICAL APPLICATIONS

Roadside Stands	Horseshoe Courts
Service Stations	Basketball Courts
Parking Lots	Beaches and Pools
Real Estate Displays	Trap and Skeet Courses
Store Fronts	Archery and Target Ranges
Signs and Displays	Tennis Courts
Delivery Platforms	Golf Driving Courses
Used Car Lots	Skating Rinks
Industrial Yards	Racing Tracks
Construction	Campus and Drill Fields
Docks and Piers	Airport Aprons
Yards and Buildings	Farms
Ship Yards	Homes

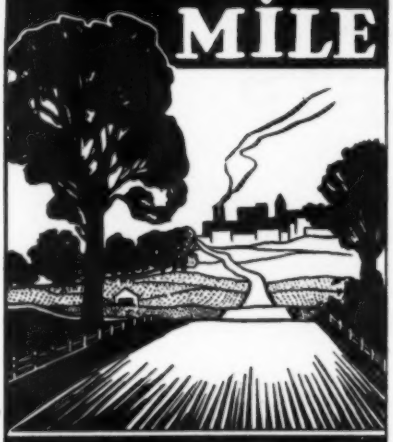
ASK YOUR WESTINGHOUSE JOBBER FOR DETAILS

WHEN YOU THINK OF *Lighting* THINK OF

Westinghouse

UMI

MILE after MILE



GALVAKOTE

ENAMELKOTE

ELECTRICTUBE

are Uniform thru constant testing

● When you order any of these brands of conduit you can be certain every foot will be as uniform in perfection as the previous one. You can be assured that GALVAKOTE ENAMELKOTE and ELECTRICTUBE will not kink, buckle or crack, or the finish of GALVAKOTE and ENAMELKOTE chip or flake.

Use conduit that has uniformity of construction and the ability to take it.

Write us for full details.

●

CLAYTON MARK & CO.

OPERA BUILDING

CHICAGO, ILL.

News of NECA

[FROM PAGE 92]

Electrical Contractors Assn. has just completed a roving trip through the far western states. He held meetings with groups of contractors and carried the message of industry cooperation to industry meetings in each city where he stopped.

Leaving New York April 4, he went directly to San Francisco and met with the executive committees of the San Francisco, Oakland and northern California associations. He attended a San Francisco contractor's meeting, and thence to Fresno to the semi-annual convention of the Northern California Electrical Contractors Association. In southern California, there was a heavy schedule of meetings, April 11-15. He met executive committees and code committees; talked to the Electric Club, the Industry Coordination committee, the Electrical Development League. He held contractor meetings under the sponsorship of the Southern California chapter in Los Angeles, San Diego and Pomona. With A. L. Stone, executive committeeman of the Pacific Division, he made convention arrangements for the October national convention.

Returning to San Francisco, Davis addressed a large industry meeting April 16, and then left for Portland, where on April 20 there were held industry and contractor meetings. April 21 and 22 were spent in Seattle, and April 23 in Vancouver, B. C. Returning to Seattle, he next visited Spokane, April 26; with April 27-29 in Salt Lake; and April 29-May 2 in Denver.

In each city the contractors turned out and industry leaders came together. The idea of further development of industry coordination and promotion was advanced. Details of the voluntary agreement plans were explained.

NECA MANUAL OF LABOR UNITS

The NECA Cost Data Committee has released up to date 89 tables for the NECA Manual of Labor Units and new tables are issued on the 15th of every month. The Manual of Labor Units is today recognized as the most valuable reference book available to the electrical contractor and his estimator.

Tables and subjects covered by the manual up to the present time are as follows:

SECTION A—INTRODUCTORY DATA

Foreword
Index
Determining Man-Hour Cost
Job Factors

SECTION B—BRANCH CIRCUIT WORK

Branch Conduit
Branch Metallic Tubing
Metallic Tubing—Branch and Motor Circuits
Metallic Tubing Fittings
Metallic Tubing—Exposed—Small Jobs
Wiring Devices
Branch Circuit Wire
Surface Metal Raceways and Fittings
Armored Cable—Non-Metallic Sheathed Cable:
  Apartment Buildings
  Commercial Buildings
  Exposed Work
Labor Hanging Fixtures
Window Strip Lighting
Branch Circuit Work

SECTION C—FEEDERS

Conduit—Feeders and Motor Circuits
Fastenings
Metallic Tubing—Feeders and Motor Circuits
Metallic Tubing Fittings
Metallic Tubing—Exposed—Small Power Jobs
Large Wire—Three Conductors per Conduit
Feeder Taps, Soldered
Feeder Taps, Solderless
Entrance Caps, Grounding Bushing and Ground Clamps
Conduit Fittings
Labor Channelling
Labor Drilling

SECTION D—PANELS AND SWITCHBOARDS

Standard Lighting Panelboards and Cabinets
Cabinets and Boxes—Built In
Panelboards and Cabinets
Switchboards
Switchboards—Assembled with Externally Operated Switches and Gutters
Safety Switches
Labor Installing Equipment Boxes on Walls
Auxiliary Gutter
Motor Starting and Equipment

SECTION E—SPECIAL RACEWAYS

Underfloor Ducts:
  Open Bottom Fibre Ducts
  Closed Bottom Fibre Ducts

SECTION F—SIGNALS

Bells, Buzzers, Annunciators and Interphones

SECTION G—OUTDOOR DISTRIBUTION

Pole Line Construction:
  Job Expense
  Trimming Trees
  Digging Holes
  Poles, Stake Out
  Poles, Roof and Gain
  Cross Arms
  Secondary Racks
  Pole Devices
  Anchors
  Pole Steps
  Wire
  Transformers
  Arresters
  Cutouts

SECTION H—EQUIPMENT

Fans
Wall Thermostats
Electric Heaters

SECTION J—MOTORS AND MOTOR SERVICING

Mounting Motors on Floor, Walls or Ceiling

SECTION K—ENGINEERING DATA

Voltage Drop
Allowable Carrying Capacities of Conductors
Conduit Sizes for 2-Wire and 3-Wire Systems
Conduit Sizes for 600-Volt Wires
Wire Gauges
Motor Wiring and Protection
Pulleys
Gear—Diametrical Pitch
Decimal Equivalents
Circular Mil and Square Mil Equivalents
Mensuration Units
Electrical Formula for Determining Amperes, Horse-Power, Kilowatts and Kilovolt-Amperes
Conversion of Power

SECTION L—SALES DATA

Computing Wages
Overhead Table
Discount Tables

Material for this department is supplied by the headquarters staff of the National Electrical Contractors Association, 420 Lexington Avenue, New York.

Keep UP-TO-DATE on new developments

through this

NEW FREE SERVICE

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation

SHOW WINDOW LIGHTING

1. A brochure on display lighting illustrating design features for increased effectiveness. Pictures of installations in prominent windows are included. Reflector & Illuminating Company.

CONNECTOR

2. A four-page folder describing and illustrating a variety of solderless connectors including the "Burndy Servit." Burndy Engineering Company.

METER TESTING

3. A 12-page catalog section illustrating and listing a complete line of "phantom loads" for meter testing. Diagrams showing connections for many types of meter tests are included. The States Company.

COMMERCIAL LIGHTING

4. A 20-page booklet illustrating and describing a large number of commercial lighting installations in various types of stores. Holophane Company.

INSULATED WIRE AND CABLE

5. A 32-page Industrial Wiring Guide for selecting wires and cables. Reviews and classifies the available types of wire and cable and the conditions to be met in use. A complete and up-to-date treatise on the factors in selection and the importance of proper wiring design. Convenient colored charts are included for quick reference. Anaconda Wire & Cable Company.

PANELBOARDS, SAFETY SWITCHES

6. Catalog 59-S, a complete catalog and price list on Colt-Noark safety switches, industrial control, meter and service entrance switches, fuses and watertight service and fuse boxes. Colt Patent Fire Arms Manufacturing Company.

PYROMETERS

7. A new catalog covering the complete line of Brown millivoltmeter pyrometers, indicating, recording and controlling pyrometers, moisture proof rotary switch, multiple key switch, control, relays, etc. Catalog 15-C. The Brown Instrument Company.

ELECTRIC HEATING DEVICES

8. Catalog, G.E.D. 650, lists small heating units of all kinds for various applications. A 60-page catalog with illustrations of electric heating installations. General Electric Company.

LABORATORY APPARATUS

9. A 40-page descriptive catalog of school laboratory equipment. A comprehensive list of apparatus developed for instructions and demonstration purposes, including multiple-tap transformers, variable capacitors, relay systems, boards, etc. Westinghouse Electric & Manufacturing Company.

TELEPHONES AND SIGNAL SYSTEMS

10. A complete catalog of telephone and signal equipment with price lists. Several new items for car and trailer signalling are included. Catalog No. 405. Connecticut Telephone & Electric Corporation.

FLOW METER

11. Catalog No. 2004, covers complete line of flow meters—indicating, recording and integrating—in both electrical and mechanical types—together with Air-o-Line flow and liquid level controllers. Explains their application to power plant, water works and gas generation service, as well as general industrial use. The Brown Instrument Company.

LAMP SALES MANUAL

12. A sales manual on Champion lamps, a simple presentation of lamp efficiency, lumen maintenance, uniformity of rating and life, with details on manufacture, outstanding installations and consumer contracts. Champion Lamp Co.

MOTORIZED APPARATUS

13. Bulletin 226 featuring motorized speed reducers, motorized blowers, inverted rotary converters, d.c. and a.c. motors, hydrolators, motor generators and gasoline electric plants. Janette Manufacturing Company.

ODOR ADSORBERS

14. A catalog illustrating the application of odor adsorbers to air conditioning and ventilating systems. Gives illustrations and many diagrams. Consolidated Air Conditioning Corp.

TRANS-O-METER

15. Catalog Section, 43-770 describes Trans-O-Meter, a portable device for measuring transmittancy of flat materials. This electronic device measures percentage transmittancy on a direct reading instrument. Westinghouse Electric & Manufacturing Company.

INDUCTION MOTORS

16. Bulletin 1600, features polyphase wound-rotor or slip-ring ball-bearing induction motors for constant speed or adjustable varying speed. Fairbanks, Morse & Co.

STEEL EQUIPMENT BUYER'S GUIDE

17. A folder designed as easy reference guide to A-S-E steel shop and office equipment. Includes loose leaf folders on lockers, cabinets, office equipment and shop equipment. All-Steel Equipment Co.

NO POSTAGE NEEDED

"Knowledge is power." Know the developments in your field. Circle the numbers of the items you want on reverse side of this card and mail today.

Postage Will Be Paid by Addressee

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BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 04, SEC. 510 P. L. & R. NEW YORK, N. Y.

ELECTRICAL CONTRACTING

330 West 42nd Street

30th Floor **New York, N. Y.**

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MOTOR-GENERATOR SETS

18. Bulletin 501, describing and illustrating motor-generator sets. Pedestal-type set. Type T generator. Reliance Electric & Engineering Company.

LIGHTING EQUIPMENT

19. Catalog No. 50, a new 182-page catalog of industrial reflectors, flood lighting equipment, flush type fixtures and lighting specialties. Pocket size with sections devoted to illumination design data and other technical material. Wheeler Reflector Company.

CAPACITORS

20. A new bulletin and price list, Catalog 1-R, describing all types of motor starting capacitors. Wet electrolytes, dry electrolytes, and paper capacitors, are listed in exact replacement sizes. Solar Manufacturing Corporation.

STREET LIGHTING

21. A number of sections for the Westinghouse Street Lighting Catalog, describing cast iron, steel and granite standards, brackets, pendants, luminaires and glassware. Westinghouse Electric & Manufacturing Company.

HEAVY DUTY RELAYS

22. Bulletin No. 131, listing heavy duty relays for 1 to 25 amperes on D.C. and A.C. circuits. Coil and contact data, contact arrangements, dimensions and enclosures are given. Ward Leonard Electric Company.

PHOTOELECTRIC BURGLAR ALARM

23. A folder describing the Signaphone invisible ray alarm system. Invisible ray photocell and light sources "cover" interiors with mirror reflectors. Signaphone Sales Corporation.

OIL CIRCUIT BREAKERS

24. Descriptive data on construction, operation and application of F-124 indoor oil circuit breakers, for industrial use, rated at 50,000 kva interrupting capacity, manual and electric operation. Westinghouse Electric & Manufacturing Company.

ELECTRIC TOOLS

25. Production duty portable drills, from 3/16 inch "Midget" to 1 inch heavy duty sizes, drill stands, hammer drills and miscellaneous portable electric tools. 48-page catalog No. 899 describing these tools in detail. Chicago Pneumatic Tool Company.

REPLACEMENT BEARINGS

26. A folder listing and describing the Fafnir Motor Cartridge unit, a ball-bearing unit to replace sleeve bearings on motors. Fafnir Bearing Company.

IGNITION TRANSFORMERS

27. Oil burner ignition transformers are illustrated and listed. Construction and design features are fully described with mounting suggestions and data tables. Bulletin 371-H. Jefferson Electric Company.

MINIATURE INSTRUMENTS

28. A catalog section describing a new line of miniature instruments for switchboard and apparatus use. Application, construction, dimension wiring diagrams and list prices are included. Round and rectangular, surface and flush types are listed. Westinghouse Electric & Manufacturing Company.

ALL-WAVE ANTENNA SYSTEM

29. An information bulletin on the installation and layout of Taco antenna systems. Several types of installations are illustrated in detail. Trouble shooting and interference elimination are discussed. Technical Appliance Corporation.

INDIRECT LIGHTING

30. Catalog No. 31, listing a complete line of indirect lighting equipment featuring both Alzak aluminum and porcelain enamelled steel finish. Many new designs are illustrated. The Edwin F. Guth Company.

PAGING SYSTEM

31. A bulletin describing a low priced loud speaker paging system for one to twelve speakers. The equipment described operates from the lighting circuit and consists of a high quality microphone, amplifier, and the required number of speakers. Stromberg Carlson Telephone Manufacturing Company.

COMPACT MEGGER

32. A folder describing a small, direct reading, battery operated, ohmmeter for circuit testing in ranges from .1 to 200,000 ohms. Four capacities and two styles are listed. James G. Biddle Company.

SILVRAY LUMINAIRES

33. A catalog listing indirect lighting fixtures, designed for use with the silvered bowl lamp. Installations in several types of establishments are illustrated. An additional bulletin describes accessories for adapting existing residential fixtures for use with silvered bowl lamps. Silvray Lighting, Inc.

AERIAL CABLE MANUAL

34. A treatise on the application and installation of single and multi-conductor aerial power cables in sizes from No. 6 up to 2,000,000 c.m. Useful data on cable selection, tables of current-carrying capacities of cable suspended in air, wire gauges and dimensions; and 28 pages covering installation methods, sketches, loading and tension charts, pole selection and guying tables, and messenger-tension constants, completes this 52-page manual, entitled "Aerial Cable," GEA-2215. General Electric Company, Schenectady, N. Y.

SAFETY SWITCHES AND PANELS

35. Catalog No. 100, a new 64-page catalog and price list of Trumbull industrial safety switches, meter service switches, circuit breakers, motor starters, solderless connectors, panelboards, and "Bus-wa." Trumbull Electric Manufacturing Company.

GRAPHIC METER

36. Catalog 337, 88 pages, describing a complete line of graphic instruments. Illustrates seven types of instrument cases, 21 chart drives, and 24 meter elements. Esterline-Angus Company.

AUTOMATIC VOLTAGE REGULATOR

37. Bulletin 5602, on electronic automatic alternator voltage regulators. Describes a compact regulator for small plants using one exciter. Complete technical information and diagrams are included. Ward-Leonard Electric Company.

TEMPERATURE CONTROL

38. A bulletin describing immersion temperature controls, from ½ to 7 ampere capacity at 110 volts. Convenient temperature conversion tables and heat conductivity data are included. Thomas A. Edison, Inc.

MEGGERS

39. A 12-page bulletin, No. 1490, on "Megger" ohmmeters and testing sets. Motor driven, direct reading and recording insulation testing and resistance measuring instruments are listed and described. James G. Biddle Company.

NEON TUBES

40. A large four-color permanent wall chart. Information on luminous tube footages, transformer data, etc., are listed in convenient form. Jefferson Electric Company.

CIRCLE NUMBERS-SIGN-AND MAIL

ELECTRICAL CONTRACTING — **May**
(Not good after August 1)

Please send me, without obligation, manufacturers' literature herein described and identified by numbers circled below.

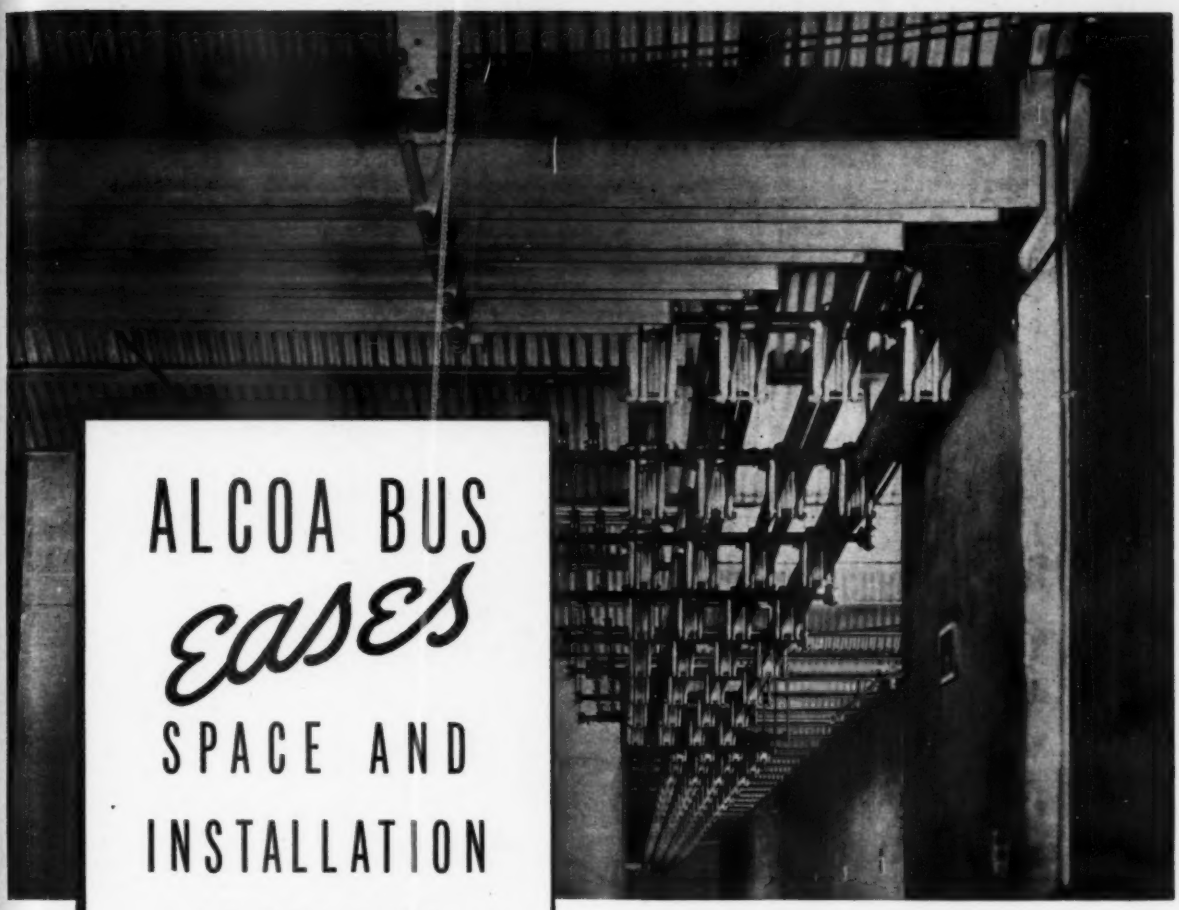
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40

NAME..... TITLE.....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....



ALCOA BUS *eases* SPACE AND INSTALLATION PROBLEMS

Alcoa Aluminum Bus Bar in Yorkville plant of Wheeling Steel Corporation.

Alcoa Aluminum Bus Bar fits practical requirements. Where factory space is valuable, light Aluminum Bus is easier to install overhead, out of the way. With weight at a minimum, the most economical provision for support is possible. Forming and joining operations are readily accomplished, and fittings are inexpensive. Inherent resistance to corrosion of Alcoa Aluminum provides natural, permanent protection against sulphur fumes and other common corrosive gases.

Alcoa Aluminum Bus Bar comes in three forms. Flats, as illustrated, are used for ordinary requirements; tubular bus is well suited to substations; Channeluminum, the rolled channel section, has a combination of high electrical capacity, mechanical strength to withstand great short-circuit stresses and ability to dissipate heat, all needed for the economical transmission of heavy loads.

We shall be glad to send you the data you will require for figuring your next job in Alcoa Aluminum. Address: ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pa.

ALCOA ALUMINUM

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With the MANUFACTURERS

R. A. Riley Dies

R. A. Riley, manager of the Graybar Electric Company at Dallas, died suddenly of influenza on April 1 at his home in Dallas, Texas. Mr. Riley joined the Graybar organization in 1917 as general specialist in Atlanta, then was sales manager in New Orleans and worked his way up to Manager of the Dallas house.

"Bob" Riley, was very active in association work for industry promotion in the southwest and very popular.

*

General Electric Company, Schenectady, N. Y., has announced the appointment of H. A. Winne, manager of sales for the mining and steel mill section of the industrial department, as general assistant to Vice-President R. C. Muir, in charge of engineering. He will be succeeded by J. J. Huether, present manager of sales for the machinery manufacturers' section. S. W. Corbin will take over Mr. Huether's former position.

*

R. J. Crump has been appointed resident sales engineer for the Silvray Lighting, Inc., Long Island City, in the state of Ohio, with headquarters in Cincinnati. Until recently he was sales engineer for the Union Gas and Electric Company of Cincinnati.

*

Aerovox Corporation, Brooklyn, N. Y., has taken over the control of the Polymet Delta Company, of Hamilton, Ontario. The Canadian plant will operate as Aerovox Canada, Limited, producing a line of Aerovox dry and wet electrolytic condensers, also mica and paper condensers, for the Canadian trade. According to S. I. Cole, president of Aerovox Corporation, the Canadian condensers are being made in accordance with the engineering and production standards of the Brooklyn plant.

Metropolitan News Photo

FLYING EXECUTIVE—Charles Borland, president of Federal Electric Company, Chicago, travelling high and light, enroute to New York, with butt and brief case. He has done 100,000 miles in the air including one trip on the Clipper over the big water.

*

Bunting Brass & Bronze Company has moved its New York City branch into new and larger quarters on the street floor at 155 Baxter St.

*

Ajax Flexible Coupling Co. has moved its Pittsburgh Sales Office to 970-B Union Trust Building. J. Guy Griffith is the representative.

Doubling in Glass

Corning Glass Works and Pittsburgh Plate Glass Company have formed a new corporation to be called the Pittsburgh-Corning Corporation. The new company will deal exclusively with the development, manufacture and sale of glass block, glass tile, colored Carrara structural glass and molded glass, used in the construction of houses, store fronts, office buildings and factories. The new company is not a merger of the Pittsburgh Plate Glass Company and the Corning Glass Works. The purpose is to create a joint corporation for the advancement of glass in the building industry, without affecting the diversified interests of either company in their other fields of glass manufacturing.

Amory Houghton, President of Corning Glass Works, will be chairman of the board of the new company and Harry S. Wherrett, president of Pittsburgh Plate Glass Company, will be its president.

*

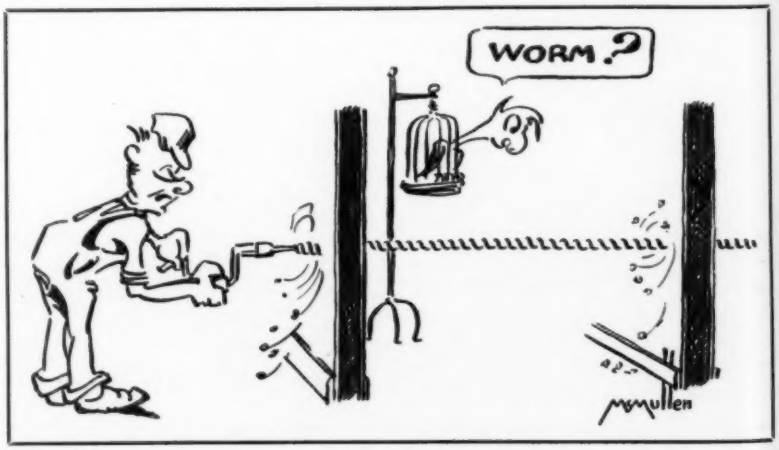
T. M. Sinclair has been appointed purchasing agent of the Line-Material Company of South Milwaukee, Wis.

*

Link-Belt Company of Chicago, announces the appointment of H. F. Brown to manage the sale of its electronic radiostat control system, for eliminating over-heating and underheating of boilers, with corresponding savings in fuel.

*

Clarence Stanley, president of the Union Trust Company of Pittsburgh, Pa., has been elected a director of the General Electric Company. Mr. Stanley is a son of the late William Stanley, one of the pioneers of the electrical industry and founder of the Stanley Electric Manufacturing Co., later the Pittsfield Works of the General Electric Company.



TODAY, MORE IMPORTANT THAN EVER
THE RLM LABEL

New, higher RLM Standards are your assurance of even greater efficiency and increased quality in RLM DOME REFLECTORS.

Important, as are these new higher standards, they simply make stronger than ever the reasons for insisting upon Reflectors with the RLM Label, when specifying or purchasing industrial lighting equipment. Basically the RLM Label stands for these essentials of efficient lighting:

1 BALANCED LIGHTING FOR INDUSTRY.
The quantity of light output delivered by a reflector does not alone determine its efficiency. It is equally important that this light be evenly distributed and diffused. There is no economy in securing maximum light output at the expense of well diffused lighting which contributes so important a part in the workman's efficiency.

2 QUALITY PORCELAIN ENAMELED REFLECTING SURFACE.
Balanced Industrial Lighting is best produced through the medium of a porcelain enameled reflecting surface. In addition to providing the ideal reflecting surface, porcelain enamel is the most durable of reflecting materials. Result: Lower maintenance and replacement costs.

3 WARRANTY OF UNIFORMITY.
The RLM Label is the buyer's assurance that every reflector so labeled meets the RLM standard specifications and is of uniform quality. A rigid inspection and testing system conducted by an independent testing laboratory insures constant conformance to RLM Standards by members of the Institute.

For further information about RLM Reflectors, you are invited to communicate with any of the following manufacturers:

ABOLITE REFLECTOR COMPANY
West Lafayette, Ohio

BENJAMIN ELECTRIC MFG. CO.
Des Plaines, Illinois

GOODRICH ELECTRIC COMPANY
Chicago, Illinois

THE MILLER COMPANY
Meriden, Connecticut

OVERBAGH AND AYRES MFG. CO.
Chicago, Illinois

QUADRANGLE MFG. COMPANY
Chicago, Illinois

SMOOT HOLMAN COMPANY
Inglewood, California

WESTINGHOUSE ELECTRIC AND MFG. COMPANY
Cleveland, Ohio

WHEELER REFLECTOR CO.
Boston, Massachusetts

RLM STANDARDS INSTITUTE
INCORPORATED

THE CERTIFICATE OF RLM UNIFORM QUALITY

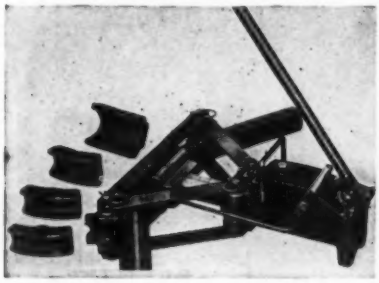
ATTENTION
ELECTRICAL CONTRACTORS

This is one advertisement in a campaign of education sponsored by the RLM Standards Institute and directed to the industrial users of lighting reflectors.

It is reproduced here so that you may see the work being done in your behalf and to suggest to you the wisdom of insisting upon the RLM Label whenever you supply or specify reflectors. Show the buyer that he gets MORE for his money from an installation of RLM Dome Reflectors—you'll make a better sale, a lasting customer, and a better profit.

GREENLEE
PROFIT MAKERS
For The Electrical Contractor

THE greater the efficiency of the tools you use, the more chance you have of meeting competition and making a profit on each job. That is why Greenlee Conduit Benders and Knockout Tools are so popular. They cut costs on every job and are liked by the men who use them.



Hydraulic Conduit Benders

Greenlee Hydraulic Conduit Benders insure profits, because they bend conduit quicker and easier than by other methods. In addition, they make smooth even bends, eliminating many fittings and making it easy to pull in wire and cable. They are easy to take to the job, too, because they are readily portable.

Knockout Tools

Greenlee Knockout Punches and Cutters are time savers and profit makers, because they make it easy to enlarge holes in switch boxes, cabinets, etc. They form clean-cut holes quickly and accurately, without any reaming or filing.

Other Tools

Hydraulic Pipe Pushers
Joist Borers — Bit Extensions
Electricians' Bits

Let us send complete information without obligation to you. Just use the convenient coupon.

GREENLEE TOOL CO.
ROCKFORD ILLINOIS

GREENLEE TOOL CO.
ROCKFORD, ILLINOIS
Please send complete information on the following:
☐ Conduit Benders
☐ Knockout Tools

Name .....
Street .....
City .....
State .....
My Jobber is 5-37

With the MANUFACTURERS

[FROM PAGE 98]

Ray W. Smith has been appointed Michigan district representative for the "Red Cap" Flood-Lite Division of the S & M Lamp Co., Los Angeles. Mr. Smith will be located at 14124 Archdale Ave., Detroit.

*

Edmond C. Powers has been appointed assistant secretary of the James F. Lincoln Arc Welding Foundation, sponsor of the $200,000 arc welding prize contest.

*

Trumbull Personnel Changes

The Trumbull Electric Manufacturing Co. of Plainville, Conn., has announced the following changes in its sales department:

C. E. Burt has been transferred from the Plainville factory to the Boston district, to succeed E. E. Frost, who is now located in Nashville, Tenn.

P. H. Kramer has been appointed salesman in Chicago, to take the place of G. T. Myers now located in St. Louis.

S. B. Storer has been moved from St. Louis to the Ludlow factory office.

C. D. Wiseman has been transferred from Dallas to Kansas City.

W. V. Fisk has been appointed Texas representative with headquarters in Houston.

*

Edwards and Company, Inc. has moved its executive offices and manufacturing to a new plant located at Norwalk, Conn. The New York District Sales Offices are located at 79 Madison Ave.

*

Roller-Smith Company, New York City, announces the appointment of Spring & Buckley, Inc., as its agents for the State of Connecticut. They will be located at 77 Church St., New Britain.

*

Oster Manufacturing Co. of Cleveland, at a recent meeting of its Board of Directors, elected R. B. Tewksbury, chairman of the board, Roger Tewksbury, president and treasurer, Arthur S. Gould, vice-president and Harry A. Maurer, secretary. The first three named, were formerly president, vice-president and secretary respectively, while Mr. Maurer was general superintendent of the company's plant at Erie and Cleveland.

Lincoln Electric Company of Cleveland has just appointed to the sales staff of its New York Office, W. H. Borst, graduate in mechanical engineering from the University of Illinois and E. A. Webber, formerly with the company's Chicago office. Their headquarters will be 330 West 42d St.

John S. Humble has been appointed arc welding consultant in Boston at 10 High Street.

*

The General Electric Co. has completed plans for the immediate erection of a new $200,000 building in Houston, Tex. The building will be located on the block bounded by Polk, St. Charles, Clay, and Live Oak streets. It will be used to house the offices, warehouses, and service shops of the General Electric Co., the General Electric Supply Corp., and the General Electric X-Ray Corp.

*

Ahlberg Bearing Co., Chicago, Ill., has completed final negotiations for the acquisition of a new modern factory building, located at 47th and Whipple Streets, covering 73,000 square feet.

*

To Push Adequate Wiring

To every prospective home owner reported by Dodge Reports, Pass & Seymour, Inc., sends a copy of a new illustrated adequate wiring booklet entitled "Planned Electrical Wiring for More Convenient Living." Approximately a thousand of these booklets are being sent out each week.

*

William H. Baldwin and Brewster S. Beach have become associated as consultants in public relations and publicity. Mr. Beach was formerly advertising manager of Carrier Corporation and previous to that was connected with General Electric Co. and American Radiator Co. Mr. Baldwin was with the International Nickel Company. Their offices are located at 205 East 42nd Street, New York.

*

William H. Borden has been appointed Detroit representative of the Synthane Corporation of Oaks, Pa. His offices in Detroit are located at 7310 Woodward Ave.

"CONCRETING-IN" was necessary on this job, so Johns-Manville Transite Korduct was selected. Thinner walled than Transite Conduit, hence lower in cost, Transite Korduct assures the same permanent economical service.

ON ALL EXPOSED LOCATIONS, as in the one above, Transite Conduit is the material to use. An asbestos-cement product, it is incombustible, weatherproof and unharmed by smoke or most corrosive fumes.

UNDERGROUND. Here, Transite Conduit's strength eliminates concreting costs and effects sizable installation savings. Its durable composition is highly corrosion-resistant and assures virtually maintenance-free service.

J-M TRANSITE KORDUCT is being installed on the six-way duct line shown above. Recommended wherever a concrete casing is required, Transite Korduct's light weight and long lengths greatly decrease your handling charges.

...AND ALL SIMILAR INSTALLATIONS INCREASE CONTRACTING PROFITS!

Both TRANSITE CONDUIT . . . used without a concrete envelope . . . and TRANSITE KORDUCT . . . used with an envelope . . . effect important installation economies

Johns-Manville
TRANSITE CONDUIT
for use underground without concrete envelope and for exposed locations
TRANSITE KORDUCT
for installation in concrete
JM

WANT to add to your profits on every type of electrical-distribution job? These two asbestos-cement conduits will do it for you!

Underground, Transite Conduit does not need to be "concreted-in". . . hence, its use eliminates the cost of a concrete envelope and assures sizable savings in installation.

In all exposed locations, this durable material permanently solves your conduit problems. For it is incombustible, weatherproof, unharmed by smoke or most corrosive fumes.

And Transite Korduct, J-M Transite Conduit's thin-walled companion, is your best assurance of economy where "concreting-in" is required. Lower in price, Korduct's light weight and long lengths reduce handling charges, as well as material costs.

And both conduits offer high resistance to corrosion . . . immunity to rot and decay. Hence, your customers profit, too, because they are assured of a lasting, virtually maintenance-free conduit system.

. . .

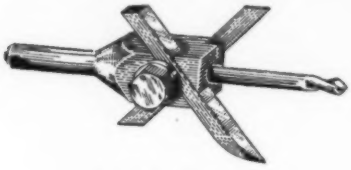
Why not get complete details? Engineering data sheets on Transite Conduit and Transite Korduct will be mailed on request. Simply write Johns-Manville, 22 E. 40th St., N.Y.C.

UMI

Equipment NEWS

Hole Cutter

The D & D hole cutter is adjustable and covers the full range of uses and sized-holes from ¾-in. to 6-in. Cuts all metals. Also bakelite, fibre, hard rubber and wood. Available in three sizes—standard, drills holes ¾-in. to 3-in., special, from 3½-in. to 6-in. and heavy duty, from 1-in. to 3½-in. D and D Tool Company, Seattle, Wash.

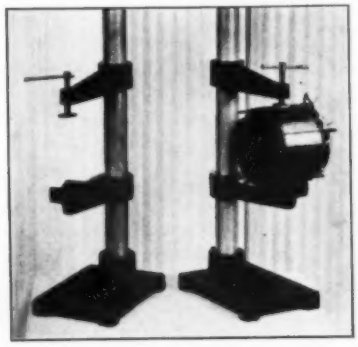


D & D HOLE CUTTER

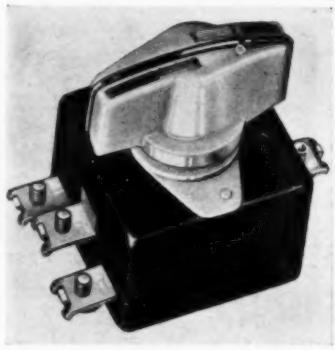
■

Handy Vise

In the electrical shop this handy vise is used to hold small motors for re-winding, repairing and testing. In the automotive repair shop it holds automobile motors and generators, pistons and spring assemblies and has many other uses requiring vertical pressure. Bushings are provided for motor shafts of ⅜-in., ½-in., ⅝-in. and ¾-in. Height overall is 30-in., base 9-in. by 6-in., swing will hold motor up to 11¾-in. diameter. Weight 25 lbs. R. E. S. Swam & Co., Hanover, Pa.



SWAM HANDY VISE



ARROW-HART & HEGEMAN SWITCH

Heater Switch

Silver break a.c. heater switch, designed for all heater needs. Four and eight positions, two and three wire balanced load, three heat, d.p. or s.p. series, parallel and other connections. Handles available in wide variety of colors to match finish of ranges, etc. Small, compact and enclosed in porcelain or bakelite. Single hole fixing or yoke mounting optional. Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

■

KALB ELECTRIC KECO TESTIT

Keco Testit

Model K135 Keco Testit is a testing device for any kind of fuse plug, auto lamp or cord set. Has many uses in factories, service stations, hospitals, apartment houses, hardware and electric stores. Operates on one standard flashlight battery using 1.25 volt mazda bulb. Length over-all 5-in. Kalb Electric & Manufacturing Co., St. Louis, Mo.

Outside Bracket

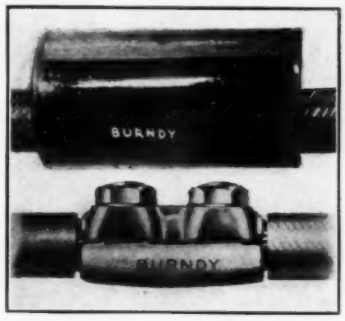
For use in garages and outbuildings to give lighting over a small area outdoors. Consists of bracket 24" over-all in length, made of wall mounting plate, 10" shallow steel shade, finished in baked enamel. Already wired. Use 60 or 100 watt lamp. Electric Distributing Co., 126 North Union Ave., Chicago, Ill.

ELECTRIC DISTRIBUTING BRACKET

■

Qiklink Insulating Cover

A cylindrical Micarta tube covering for the "Qiklink", a connector for joining two cables on end. By slipping the cylindrical body over the connector and snapping the two plugs into position, a neat, compact, safe insulation is made in minimum time. Available in complete range of sizes to accommodate all sizes of Qiklinks. Burndy Engineering Co., Inc., 305 E. 45th St., New York.



BURNDY QIKLINK TYPE QS AND COVER

■

Disc Edger

Type E-17 is a high speed, disc type machine with dust pick-up system, for sanding floor edges, stairs, closets and other small areas. High, constant speed assured by a specially wound, heavy-duty, 1½ h.p. universal motor. Dust intake opening extends around 75 per cent of the sanding disc. Polished aluminum frame designed along modern lines with easy-grip, balanced handles. Flood light may be turned on or off by a shielded

IN Westinghouse *Safety Switches*

DE-ION

More quickly than you can blow out a match, the "De-ion" grids in a Westinghouse Safety Switch extinguish dangerous arcs by confining and dividing them into harmless segments. This amazing principle, developed in Westinghouse laboratories and applied to all Westinghouse switches rated at 575 and 600 volts, is one reason for their long life and safe, efficient operation.

A further assurance of years of carefree service is supplied by the Diamond-Pointed Break Jaw and Extended Blade, also exclusive with Westinghouse. This principle confines beading to points which fall *outside* contact areas when the switch is closed. Clean, smooth contact surfaces are maintained indefinitely.

Other Westinghouse plus values: Extreme simplicity; one-piece or milled-and-ground copper parts on a one-piece non-carbonizing composition base eliminate customary bolts and screws; entire assembly completely open for inspection.

All commercial sizes and ratings, Types A, C and D. Call your local:

Westinghouse Office Electrical Wholesaler
Motor Dealer

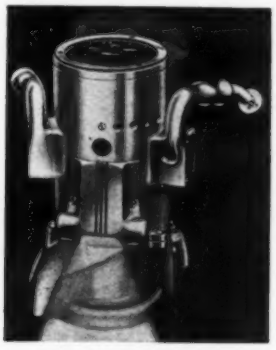
Westinghouse Elec., East Pgh., Pa.

J 20301

HERE'S HOW IT WORKS!

In ratings of 575 and 600 volts, Westinghouse Safety Switches are equipped with the exclusive "De-ion" Arc Quencher. In the past, arcs have been broken by "stretching." The "De-ion" quencher confines, divides and extinguishes arcs instantly—obviously preventing concentration of burning heat on contacts or arc barriers.

turn switch. Hardened steel guard surrounds disc for use in contact against baseboards, stair risers, etc. Dust bag with zipper opening attached with a snap clamp to dust outlet large enough to prevent back pressure. Porter-Cable Machine Co., Syracuse, N. Y.

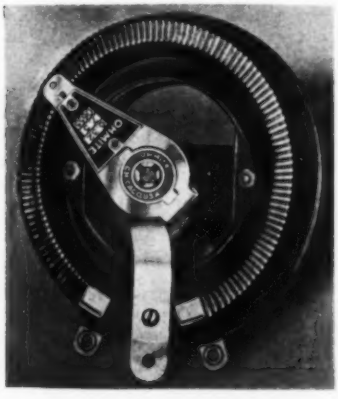


PORTER-CABLE DISC EDGER

■

Power Rheostat

Model "U" 1 k.w. rheostat designed for controlling many types of loads, such as speed of small motors, lamp dimming in advertising displays or generator field control of arc welding machines. Rated at 1,000 watts. Shaft and bushing assembly insulated from live circuit by porcelain. Smooth, uniform and positive contact made on large flat surface of rheostat windings by a spring-held contact arm fitted with a universal-joint action, metal-graphite contact shoe. It spans several resistance steps, making pressure on any one step negligible. Ohmite Manufacturing Co., 4835 W. Flournoy St., Chicago, Ill.



OHMITE POWER RHEOSTAT

BRYANT ELECTRIC SWITCH

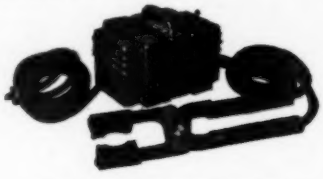
House Switch

Bakelite switches for moderate load service, for home installations. Completely enclosed in bakelite casings. Easy-to-wire terminals at side. Single pole and three point types rated at 10-amp. 125-volts; 5-amp., 250-volts. Bryant Electric Co., Bridgeport. Conn.

■

Electric Pliers

No. 10 large thermo-grip electric pliers, used for soldering lugs up to 1,050-amp. or sweating pipe fittings up to 2¼-in. diameter, under continuous operation. When used intermittently, will handle pipe or fittings up to 4-in. diameter. It is claimed that they sweat joints without unsweating adjacent connections, hold work firmly while soldering, heat the work evenly from both sides and eliminate open flame hazards. Ideal Commutator Dresser Co., Sycamore, Ill.



IDEAL NO. 10 ELECTRIC PLIERS

■

Rotating-Cam Switches

A line of rotating-cam switches, designed for built-in control applications and adaptable to a variety of electrical functions and machine requirements. For non-built-in applications, devices available as standard switches without flanges used for flush-mounting on machines. Designated as G-E CR3300, the new line is made in a number of electrical and mechanical modifications, making it adaptable to applications varying from machine-tool motor control to steel-mill master switching. Two sizes available. Four standard types obtainable for controlling (1) single-speed motors for reversing application; (2) two-speed, separate winding motors for non-reversing application or for one speed forward and one speed reverse; (3) two-speed, single-winding motors for non-reversing application, or for one speed forward and one speed reverse; and (4) three- or four-speed motors for three or four speeds forward and one speed reverse. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC CAM SWITCH

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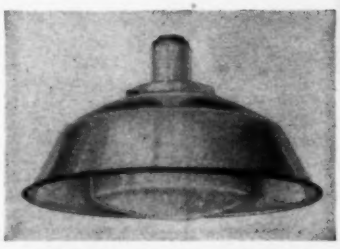

WESTINGHOUSE MERCURY REFLECTOR

Glassteel Diffuser

Designed to distribute light from 250-watt high intensity mercury lamp, where mounting height is under 18-ft. Suitable for lighting machine shops, plating and polishing rooms, assembly lines and departments, pattern shops, tool rooms, welding forge, heat treating rooms, etc. White porcelain enameled reflector and diffusing glass globe. Reflector has six openings at top, permitting some light to reach ceiling. Various types of hoods available. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

■

Motor-Operated Brake

The torque motor-operated brake control for hoists, elevators and similar equipment, eleminates the usual solenoid control. Brake is applied by a spring and is released by a torque motor, a type which is capable of being stalled across the line full torque without overheating or excessive current. It is

THE UNSEEN HAND

. . . that makes this type of installation COMPLETELY AUTOMATIC

A progressive Electrical Contractor scores with a simple but effective floodlighting installation. To make the installation completely automatic, he includes a Sangamo Time-Switch. Your opportunities to increase your business the same way are excellent!

But . . . you must *first* sell the prospect on the many advantages of *the unseen hand*—how it takes complete and dependable control of window, sign and flood-lighting. Try it! You will discover that Sangamo Time-Switches are hard to beat as "leaders" for new business.

Sturdily built, simple in operation, self-starting, equipped with silver contacts—that's Sangamo Form K Time-Switch.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

UMI

[FROM PAGE 102]

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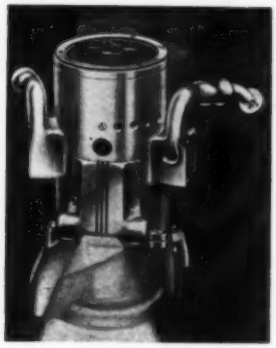

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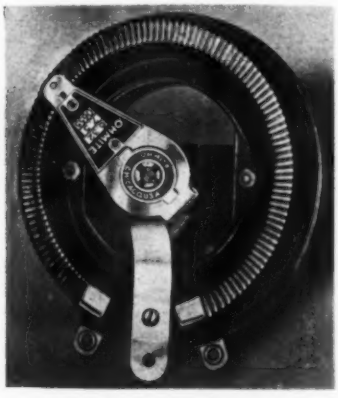

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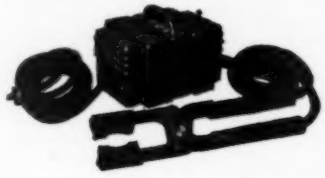

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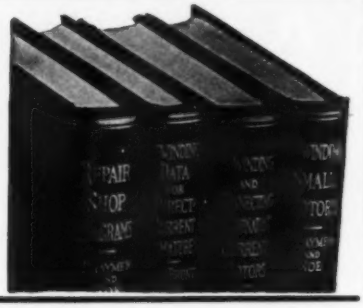

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THIS set of books should be on the shelf of every man who ever has to touch a motor for purposes of repairing it or changing it to meet different operating conditions. In shop language and with practical shop methods it covers every step in stripping, rewinding and connecting a.c. and d.c. motors of all kinds.

Do you know how to:

—lay out a wave winding
—test a.c. and d.c. motors to locate grounds, shorts, opens, quickly and positively
—properly record data when stripping armatures so that it will be instantly usable for correct rewinding by yourself or any experienced winder at any time afterward
—determine how many coils can safely be cut out
—lay out single-phase fan motor windings
—change single-phase windings for two- or three-phase operation
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—lay out frog-leg windings
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How to change motors for different operating conditions

Here is all the information you need in order to determine what changes various types of motors permit; to lay out new windings for specified service conditions; and to handle every step in the work with satisfactory results. Covers all types of motors, from those used in small household and commercial appliances of all kinds, to mining and railway motors. Explains principles underlying the different types of winding; gives definite instructions for doing the various rewinding jobs. Also gives many data, tables and diagrams constantly needed by the repair man, including data difficult to get from any other sources.

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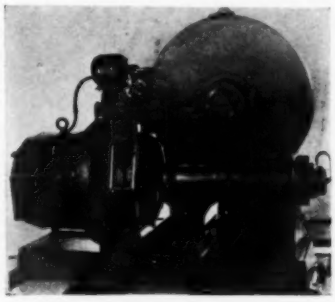
Equipment NEWS

[FROM PAGE 104]

tages of lower first cost, reduced maintenance expense and superior efficiency. Motors are standardized to fulfill any desired "on-and-off" operating cycle. Ohio Electric & Mfg. Company, Cleveland, Ohio.



OHIO ELECTRIC TORQUE MOTOR

■

HUBBELL DUPLEX FUSED ADAPTER

Duplex Fused Adapter

No. 7980 adapter for range, receptacles. Converts an idle 50-amp., 250-volt, 3-wire range outlet to a standard 15-amp. duplex convenience outlet, protected by a standard 15-amp., 125-volt fuse plug. Easily attached by plugging into slots of range outlet. It is claimed that fuses are replaceable from the back in a few seconds. Made of black bakelite. Harvey Hubbell, Inc., Bridgeport, Conn.

■

Beam-Director Attachment

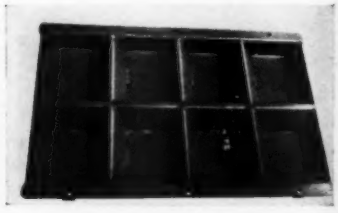
Beam-Directors are designed for building up illumination over areas 30 to 36-in. in diameter on machines or work benches located within 10 or 12-ft. of reflector to which they are attached. They add 10 to 15 footcandles more illumination, and eliminate shadows. With the addition of one or more beam-director attachments to any reflector in the overhead system, necessary extra light can be directed anywhere it is desired. Available in two sizes for 200 watt and 300-500 watt incandescent lamps. Benjamin Electric Manufacturing Co., Des Plaines, Ill.

BENJAMIN BEAM-DIRECTOR

■

Welded Base

Welded base for medium-sized motor-generator sets, with welded V-shaped reinforcing ribs, providing strength and freedom from distortion. The top, sides and base flange are pressed from a single sheet. All welds are "stress-relieved" after completion. Advantages claimed are reduced weight, no delays for making special patterns for non-standard needs, more uniform structural strength and no danger of breakage in transit or when tightening bolts or moving with bars. Reliance Electric & Engineering Co., Cleveland.



RELIANCE ELECTRIC WELDED BASE

■

Circuit Breaker

Class TCR-1 indoor oil-tight circuit breaker, with rating of 75,000 Kva interrupting capacity available for automatic and non-automatic operation, in both two pole and three pole types. The 600 and 1,200-amp. breakers are rated at 30,000-amp. for five seconds and 45,000-amp. for one second and the 2,000-amp. breaker at 40,000-amp. for five seconds and 50,000-amp. for one second. "Turblator" arc extinction effects quick quenching of arc, reducing arc length, tank pressure and contact burning, which combine to decrease oil and breaker deterioration and reduce circuit interrupting time. Each breaker furnished with oil gage, drain plug, and exhaust pipe with baffled connection to

Says SUNNY LUMENS *the Goodrich Reflexpert*

"It's the best-looking summer we've seen in a coon's age—with improvements galore—old prospects coming to life—new business opening up. Turn on the juice . . . get after outdoor business among gas service stations, taverns, stores, etc. Wherever there's a business to be advertised—there's a sign lighting prospect."

GOODRICH SIGN REFLECTORS

Build Business for You and Your Customers

● Signs illuminated at night have greater power of attraction—they snap out of the darkness—demand attention. They're more compelling in darkness than in daylight.

There's a Goodrich Sign Reflector of the right size and shape to meet each requirement for illuminating round, square, rectangular or long and narrow signs. Each fills a specific purpose—trims light to fit the sign without waste at the sides and corners—provides proper brilliance without unpleasant glare. Goodrich Sign Reflectors put you in strong with your customers because they're supplied with the Goodrich Resilient Socket that holds lamp in normal, vertical position, prolongs lamp life, saves maintenance and upkeep expense.

Keystone Sign Reflector

Round Sign Reflector

Rectangular Sign Reflector

Send for Information

Let Goodrich engineers help you with your sign lighting problems. There's no cost or obligation. Ask us to send descriptive folder on Sign Reflectors.

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for NEATER
CLEANER
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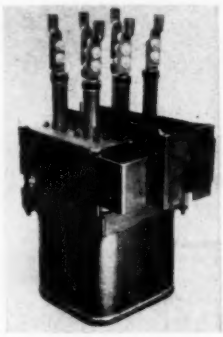
Complete Lists Covering Industry's Major Markets

Equipment NEWS

[FROM PAGE 106]

tank head, designed to drain the trapped oil back into the tank. Roller-Smith Company, 233 Broadway, New York.

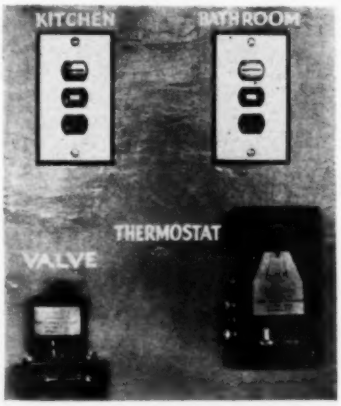


ROLLER-SMITH "TURBLATOR" BREAKER

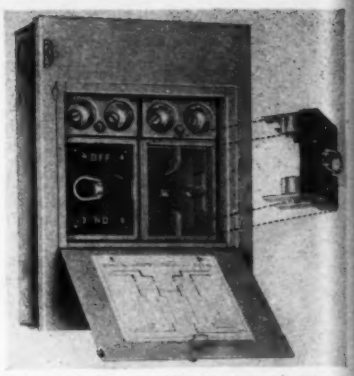
■

Gas-Mizer

The Gas-Mizer is an electric control to govern gas-water heaters, by switches in the bathroom, kitchen and laundry. When water is heated the Gas-Mizer thermostat shuts off gas. Thermostat is positive, being equipped with mercury switch. When "On" button is pressed, the bleeder valve opens and incoming gas pressure lifts a floating disc opening valve to full. When circuit is broken, bleeder valve closes building up a pressure in the chamber above the disc much greater than pressure below, thus forcing disc onto its seat. Valve is then entirely closed and sealed against leak. Has no fibre washers to expand and contract, making it free from gas leaks. Safety Control Company, Rochester, N. Y.



SAFETY CONTROL GAS-MIZER



ARROW-HART & HEGEMAN SERVICE UNIT

Multi-Service Units

Entrance, meter and load side distribution for residences, apartments, stores, etc. Sequence switch with or without range and branch circuits. Combinations of pull-out switches and plug fuse cut-outs for branch lighting circuits. Flush or surface styles. May be furnished with plug fuse distribution at the top. Supplied with or without meter trim. Meter trim switches provided with or without meter testing facilities. Available in all standard styles. Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

■

WESTINGHOUSE ANGLE REFLECTOR

Angle Reflector

A vapor proof angle reflector for use with 250-watt high intensity mercury vapor lamps designed for service conditions where excessive moisture and non-combustible dust are present. In locations with overhead obstructions, these units, mounted on sidewalls, provide good illumination on horizontal or vertical surfaces. Consist of cast iron hood with medium socket, opal glass globe and porcelain enamel reflector.

YOUNGSTOWN

BUCKEYE YOUNGSTOWN CONDUIT

HOT GALVANIZED
ELECTRO GALVANIZED
BLACK ENAMELED
ELECTRICAL METALLIC TUBING

YOUNGSTOWN produces the four types of conduit listed above under conditions of intensive metallurgical control and rigorous inspection which assure uniformity in analysis, ductility and finish. The "workability" of Buckeye Conduit thus maintained enables journeymen to make installations which add to a contractor's reputation for quality workmanship.

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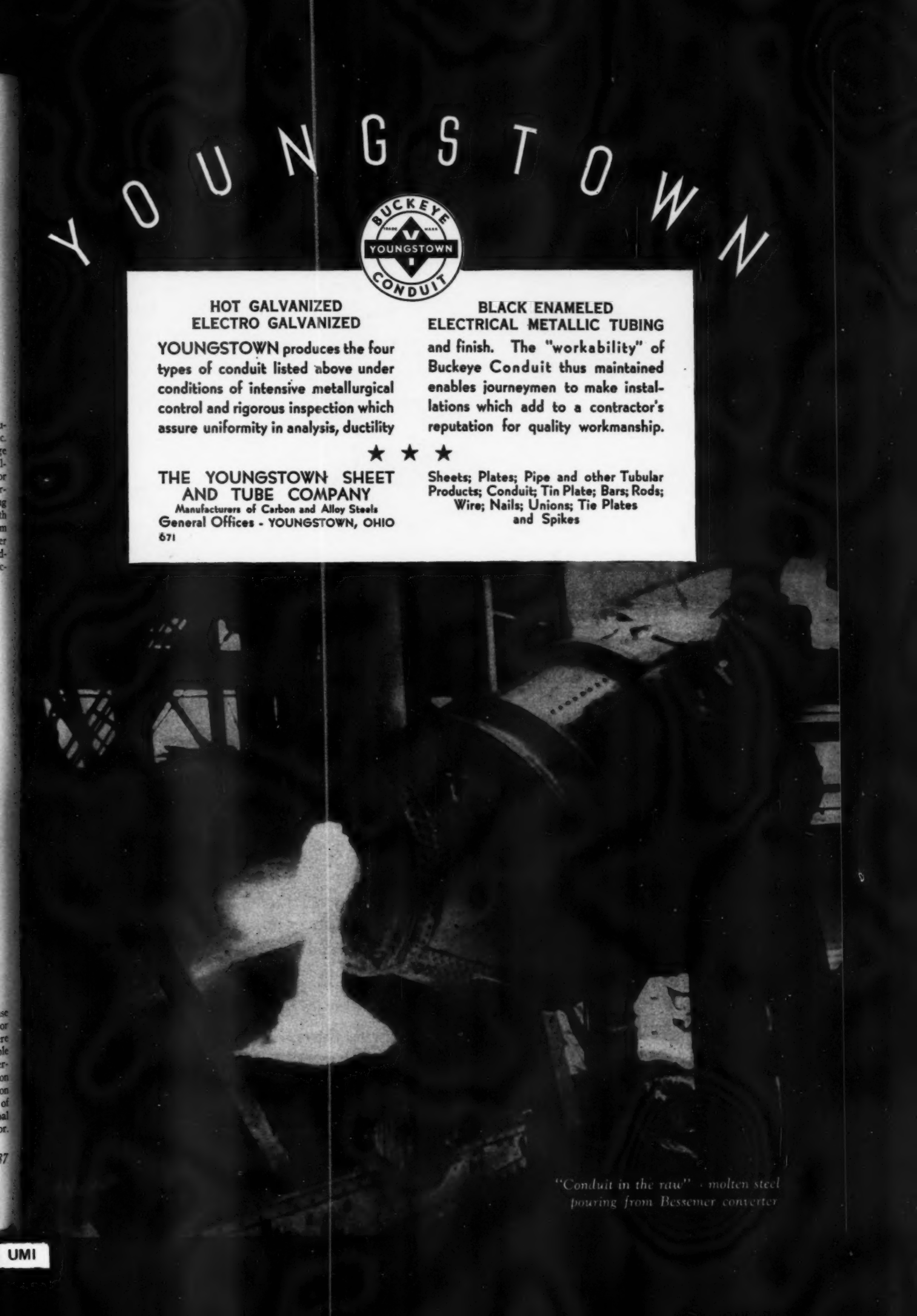
General Offices - YOUNGSTOWN, OHIO

Sheets; Plates; Pipe and other Tubular Products; Conduit; Tin Plate; Bars; Rods; Wire; Nails; Unions; Tie Plates and Spikes

671



"Conduit in the raw" - molten steel pouring from Bessemer converter

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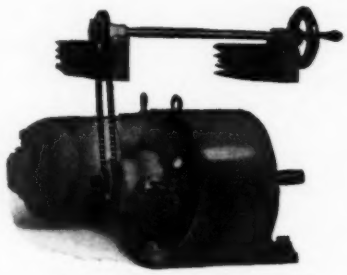
Equipment NEWS

[FROM PAGE 108]

It is vapor proof regardless of whether or not connected to a vapor proof conduit box. Hoods finished in green, baked, acid resisting enamel. Hood and globe are threaded and gaskets are provided for vapor proof enclosing globe. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

■



U. S. ELECTRICAL REMOTE CONTROL

Remote Mechanical Control

A new line of standardized parts for obtaining variable speed with remote control. Bearing supports, shafting, sprockets, and chains have been standardized for use with U. S. Varidrive motor. Positive speed control. Infinite speed variation within the range of the machine. U. S. Electrical Motors, Inc., Los Angeles, Calif.

■

WAGNER ANNULAR RESILIENT MOUNTING

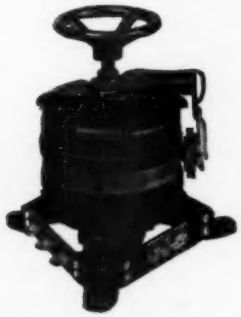
Annular Resilient-Mounted Motors

Annular-type resilient-mounted motors, ⅛ to 1 h.p., a new mechanical modification to Wagner line of fractional-horsepower motors. Available on repulsion-start-induction, split-phase, capacitor and polyphase types of motors. Motor base made of rolled sheet steel. Motor is locked into place in cradle-arms by latches and latch-nuts. Also available with belt-tightener bases, designed so that belt tension increases with load, preventing slippage, resulting in reduced belt and bearing wear, less power consumption and quieter operation. Wagner Electric Corp., St. Louis, Mo.

■

Transtat Voltage Regulator

The type "TH" Transtat voltage regulator for a.c. circuits, to deliver an adjustable output voltage to electrical equipment, such as lamps, motors, rectifiers, testing transformers, heating devices, etc. Will control voltage, illumination, motor speed or heat. Standard sizes up to 2.5 Kva on either 115 or 230 volt lines. American Transformer Company, Newark, N. J.

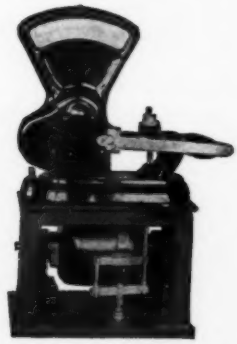


AMERICAN TRANSFORMER REGULATOR

■

Dynamometers

This unit designed for fuel-pump testing, is finding other uses for testing of small devices including fractional-horsepower motors. Capacity ¼ h.p., at 1150 to 3600 rpm, 250 volts. Special scale calibrated to subdivisions of 1/100 lbs. General Electric Co., Schenectady, N. Y.



GENERAL ELECTRIC DYNAMOMETERS

Advertising reduces "LOST MOTION" ...in your sales work

SUPPOSE a "time-and-motion study" expert were to analyze the typical day of a salesman.

How much time would he find lost in reception rooms of prospects? How many lost motions in "missionary calls"? How many fruitless efforts trying to interview men who ordinarily "don't see salesmen"? How many repetitions of elementary explanations to prospects who don't know your company or its products?

The expert's report would say . . ."Too many man-hours wasted! Too many lost motions! Let's find a mass production method of doing this preliminary work."

Advertising is a mass-production sales tool. It makes calls regularly on all prospects, at about one cent a call. It helps the salesman use his time more effectively to make more sales, and so make more money for himself and for his company.

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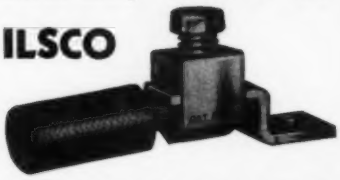


SOLDERLESS CONNECTOR

NOTICE: The *triangular wedge* formed by the tang and V-bottom collar, which forces the wire into a *solid mesh*—

NO set-screw contact . . .
NO flattening or separating of wires . . .
NO limitation to one size wire . .
NO shearing effect whatsoever . .
NO special tools required to make connection . . .

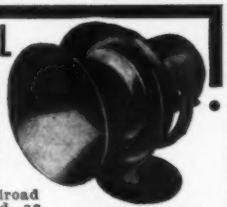
NO need for you to search any longer for the PERFECT Solderless Connector—WE HAVE IT!

Ilsco solder lugs show the size of the largest wire they will take.

FREE—A large display board, containing mounted samples of ILSCO lugs. Sent upon request.

ILSCO COPPER TUBE & PRODUCTS, INC.
5629 Madison Road. Cincinnati, Ohio

New **FEDERAL**
INDUSTRIAL SIRENS



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Write for New Industrial Bulletin No. 57

New FEDERAL No. 30 HORN
With Directional Projector

No. 30 Horn

Used in various dept's. In large plants, yards. Sound projected in different directions for calling busy people. Voltage 6 to 250 A. C. only—Type 40 for D. C. Rugged in construction—Built for a lifetime. Used in shops and plants everywhere.

***New FEDERAL No. 30-A**
With Grille Front

Same as No. 30 except for grille front. Diaphragm is of special steel. *Inquire about New Industrial Bulletin No. 57 Today.*

No. 30-A

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Advertisers' Index

*Adam Electric Co., Frank..... 91
*Allen Bradley Co.....63, 64
Aluminum Co. of America..... 97
*American Blower Corp..... 89
*American Transformer Co..... 88
*Anaconda Wire & Cable Co.....30, 31
Appleton Electric Co..... 29
*Arrow-Hart & Hegeman Elec. Co.. 4

*Benjamin Electric & Mfg. Co..... 59
Bull Dog Electric Products Co.... 45
*Burndy Engineering Co..... 70

*Chase-Shawmut Co..... 58
*Colt's Patent Fire Arms Mfg. Co.. 79
*Columbia Electric Mfg. Co..... 60
Consolidated Edison Co. of N. Y. 68
*Co-op Electric Supply Co..... 112
*Crescent Insulated Wire & Cable Co. 37
*Curtis Lighting, Inc..... 43
*Cutler-Hammer, Inc..... 25

*Dongan Electric Mfg. Co..... 62

*Electrical Safecote Conductors..26, 27
Ellicott Manufacturing Co..... 88

*Federal Electric Co..... 112
Ferranti, Inc..... 112
*Fullman Manufacturing Co..... 84

*General Electric Co. (Bridgeport). 34, 35, 47
*General Electric Co. (Schenectady) Inside Front Cover, 83, 86
Goodrich Electric Co..... 107
*Graybar Electric Co..... 6
*Greenlee Tool Co..... 100

*Hartman, B..... 84
*Hazard Insulated Wire Works..... 28

*Ideal Commutator Dresser Co..... 76
*Illinois Electric Porcelain Co.... 50
*Ilsco Copper Tube & Products, Inc. 112
Irvington Varnish & Insulator Co. 55

*Jefferson Electric Co..... 75
*Johns-Manville Co..... 101

Kraeuter & Co..... 87
*Krueger & Hudepohl..... 88

*Mark & Co., Clayton..... 94
*McGill Manufacturing Co..... 78
McGraw-Hill Book Co.....70, 110, 106
Minerallac Electric Co..... 68
*Multi Electrical Mfg. Co..... 78

*Ohio Carbon Co..... 61
*Okonite Co..... 69

*Pass & Seymour, Inc..... 81
Peerless Electric Co..... 60

*Quadrangle Manufacturing Co..... 38

R. L. M. Standards Institute..... 99
*Rattan Mfg. Co..... 108
*Reflector & Illuminating Co..... 49
*Reliance Automatic Lighting Co.. 68

S. S. Jobbing House..... 112
*Sangamo Electric Co..... 105
*Sherman Mfg. Co., H. B..... 76
*Signal Elec. Mfg. Co..... 84
*Square D Company..Inside Back Cover
*Standard Transformer Co..... 112
*Steel & Tubes, Inc.....56, 57
Steelduct Co..... 42
Sticht Co., Herman H..... 60

Technical Appliance Corp..... 76
*Thompson & Sons Co., H. G..... 46
*Trico Fuse Mfg. Co.....Back Cover

*United States Rubber Products, Inc. 2, 3, 39

*Van Cleef Bros..... 77

*Wagner Electric Corp..... 54
*Westinghouse Electric & Mfg. Co.....41, 67, 71, 85, 93, 103
*Wiremold Co.....72, 73

Youngstown Sheet & Tube Co.... 109

* See 1936–1937 Buyers' Reference number of Electrical Contracting for additional information on these companies and their products.

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The Ferranti Phase Rotation Indicator is provided with red, yellow and blue handles on crocodile clips which distinguish phase to which they should be attached. Direction of disc rotation tells immediately if phase rotation is correct. Invaluable also for correctly marking bus bars and leads.

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